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Obstacles to Business Revival

Necessity for More Effective Production Emphasized—Instability of Prices, and Shortage of Capital Still Hamper Production—Substantial Progress Is Being Made

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THE return to normal business conditions is retarded by a number of influences. The first of these is the fact that the depression under which we are laboring is not merely local or national but is only one phase of a world depression. Unemployment, financial difficulties, and sluggish business are reported from practically every country in Europe, from China, Japan, and India, from the West Indies, particularly Cuba, from Central and South American countries, and from Canada. Some of these countries, such as Germany, Russia, and Austria, seem to be on the verge of bankruptcy; and in some regions the depression is growing noticeably worse rather than better. With the relations of all parts of the world so close that every country depends for its well-being to a greater or lesser extent upon sales to and purchases from other countries, it is obvious that there can be no real improvement in the condition of any one country until there is improvement in the general situation. It is clear that so far as this country is concerned we can look for no great extension of our foreign trade until our leading customers get back on their feet economically. Hence signs of improvement in business conditions in the United States are likely to be deceptive except as they are accompanied by similar evidences of improvement throughout the world.

A second influence which is retarding recovery is the expectation on the part of most persons that there will be further price declines. There have been sharp recessions in the prices of various groups of commodities but these have been "spotty"—greater declines have occurred in some groups than in others. This inequality in the decline of various commodities is indicated by the following table. The index numbers are based on wholesale prices, with the prices for 1913 assumed as 100.

	High	March 1
Farm products	246	129
Foods	287	150
Cloths and clothing	356	198
Fuel and light	284	218
Metals and metal products	195	146
Lumber and building materials	341	222
Chemicals and drugs	222	178
House furnishings	371	277
Miscellaneous	247	180

So long as these wide differences prevail in the prices of different commodities there can be no confidence in the stability of prices. If, in a normal period, say 1913, a certain price relation prevailed between farm products and house furnishings, and if at present that relation has been changed so that house furnishings command relatively a much higher price than farm products, it is clear that the exchange relations between those having farm products and those producing house furnishings will be interfered with. The same may be said of the relations between any other groups of producers. Either the prices of one group must rise or the prices of the other group must fall before the products of the various groups attain stability in value. That this leveling process is going on becomes clear when it is noted that the difference between the highest group and the lowest group on March 1 was 148 points, whereas on January 1 the difference between the highest and lowest was 202 points.

How Low Will Prices Go?

The price situation hangs over the market as a depressing influence in still another respect. Most persons expect the general level of prices to go still lower. Two movements may therefore be expected, a fall in the prices of the highest group to a level approaching that of the lowest group and at the same time a decline of prices for commodities in all groups, in even the lowest, to still lower levels. The disturbing question is, to what extent will the decline go? People in discussing this question usually assume that prices will not get back to the pre-war level and there are only a few daring souls who predict a decline to the 1913 level. It may therefore sound incredible to suggest that prices may gradually work down during the next five or ten years to a lower level even than that of 1913. Yet, unless the nations of the world decide to abandon the gold standard there is more than a possibility that this will be realized.

The price level varies with the quantity of money in circulation. The word "money" here includes not only gold and silver but government paper money, bank notes, Federal Reserve notes, and deposit currency. The great increase in the medium of exchange in the United States during the past few years came through the increase of deposit currency which was created by credits extended through the mediation of the Federal Reserve system. But while there has been very little gold in actual circulation, gold is and has been the solid foundation upon which the credit structure could be reared. Although improvements in the banking machinery in this country and the desperate needs of war in other countries have led to the expansion of credit currency either in the form of deposits or notes on a much smaller foundation of gold, the financiers of every nation have recognized the desirability of keeping the gold reserve against outstanding notes and credits as large as possible.

Must Have Adequate Gold Reserve

Under the stress of war and subsequent attempts at reconstruction, the increase in paper currency throughout the world has greatly outrun the additions to the gold reserve. The paper money of the world has increased from seven and one-half billions of dollars to

more than eighty-one and one-half billions exclusive of more than thirty-four billions of dollars issued by Soviet Russia. The average percentage of gold reserve to notes outstanding in 1914 was about 66.3. In 1920 it was 9.2 and in many of the nations it was negligible: for example, in Germany it was about 0.6 per cent. If approximately 66 per cent was regarded as a proper average gold reserve against outstanding notes before the war, obviously 9 per cent is a very inadequate reserve now. Assuming then that it will be the aim of most nations to get back to a gold basis with adequate reserves of gold, either the large outstanding paper issues in whatever form must be decreased or the gold reserves back of them must be increased tremendously, or, what is more likely to happen, both objects will be sought to some extent.

What is the prospect of increasing the supply of gold? In 1915 the total gold production of the world was about $470,000,000; in 1919 it was only $350,000,000. That the production for 1920 was still lower may be judged by comparing the output for the United States for the three years. In 1915 the United States produced $101,000,000 of gold; in 1919 $59,000,000; and in 1920 $49,500,000. It can thus be seen that it will take many years to bring up the gold reserves of the world to a point where they can maintain, in safety, the tremendous volume of credit currency now outstanding.

The conclusion then must be that the present volume of currency throughout the world will be gradually decreased. If this occurs the price level which is established on the basis of existing quantities of money must likewise decline. But will the decline carry prices below the 1913 level? The answer to this depends on the one hand upon the relation which existed between the volume of production in 1913 and the quantity of money at that time, and on the other hand upon the volume of production likely to be achieved during the next few years and the quantity of money which will be available to move that production. It seems likely, with the gigantic requirements for reconstruction and for new production to meet the needs resulting from the actual waste during the war period and the interference with normal production, that when the world once again gets into its stride it will produce commodities of all kinds in a volume much greater than ever heretofore achieved. This will require a larger available gold reserve than there was in 1913 if prices are to remain on the 1913 level. While the total stock of gold will be larger than it was in 1913, it is extremely unlikely that the stock will show as large a ratio to needs as the 1913 stock represented of the 1913 needs.

Declining Rather Than Low Prices Hamper Business

Hence there is at least a strong possibility that the level of prices may ultimately get below that prevailing in 1913. This outlook would tend to make for slow revival and sluggish business during the next few years. It should be noted however that such a low level of prices, if it should be attained, does not indicate permanently retarded business. It is not low prices that hamper business but declining prices. It is the uncertainty of the price outlook which creates timidity and prevents business development. That there can be a large, even an expanding volume of business on a basis of low prices is evident from experience in the United States during the period from 1873 to 1893. An examination of the price situation thus seems to forecast a period of uncertainty and slow recovery with the possibility of permanent and substantial improvement in business based upon a considerably lower price level.

Another influence delaying recovery is the abnormally small number of business failures. The number of failures and the amount of the liabilities of failed concerns have been increasing however in recent months. For the first three months of 1919 failures to the number of 1,904 were reported; for the similar period in 1920 there were 1,627; and in 1921 there were 4,870. The proportion of failures in January, 1921, to the concerns in business, although larger than the years immediately preceding, was still 10 per cent below normal. So long as the number of failures was less than normal, it could be assumed that there were large numbers of concerns in business which would be shaken out as conditions became unfavorable. Events have supported this assumption; the number of failures for the first three months of 1921 is greater than for any three-month period since the first quarter of 1915, and there have been only four other occasions in the last thirty years when there have been so many failures for a three-month period. The liabilities of failed concerns for the first quarter of this year were $178,589,980—the largest for any quarter of which there is record.

With further price declines in prospect it may be expected that the number of business failures will continue to be large. It is well known that the failures in the past few months would have been very much more numerous were it not for the fact that the banks have virtually taken over the management of a number of unsound concerns and are administering them temporarily so as to liquidate their indebtedness. Of course there is a limit to what the banks can do in this respect. In 1920, 155 banking institutions were compelled to close their doors, the majority of which were forced into that plight by the financial difficulties of their customers. So long as there are large numbers of unsound businesses in existence there can be no real improvement in conditions, for there can be no certainty that some of these weaker concerns will not undermine their competitors and carry down their creditors with them in their dying struggles.

Taxation and Tariff

Business improvement is hampered also by the uncertainty regarding Federal taxation and tariff policies. New legislation concerning these matters always causes uncertainty, and this is particularly the case at the present time when the possibility of harm from unwise legislation is magnified by general world conditions. If the coming session of Congress adopts a high protective tariff, as it now seems likely it will, we may get a temporary fillip to business at the expense of permanent improvement. It requires little argument to convince a sensible and unprejudiced man that, if restoration to a sound economic basis in this country depends upon a similar restoration in other countries, the erection of tariff barriers which are designed to injure other countries will of course not aid permanently in our rehabilitation. With the leading commercial nations of the world heavily indebted to the United States it would seem to be the height of stupidity to put impediments in the way of their payment of these debts in the only manner they can possibly do so—that is, by sending us their products.

Similarly the subject of taxation, if it is to be handled intelligently, cannot be safely intrusted to those whose

guiding principle is political expediency—and usually short-sighted political expediency. Payment for our expenditures in the war and for our huge post-war commitments must be made. The dose is bitter but it will not gain sweetness by spreading it out in smaller measures over a longer period of time. There must be heavy taxation for there is no ledgerdemain by which a government can pay its debts. Senator Smoot has recently estimated that the United States will have to collect taxes of about $3,500,000,000 annually for the next twenty-five years. The funds for this purpose must be obtained from those who possess them. Unless the governments of the world show, by levying heavy taxes, by reducing their expenditures in every possible manner, and by repaying their loans as rapidly as possible, their desire to relieve the financial burdens of the people, we can expect no real improvement. So long as the governments of the world are in the money market in the capacity of borrowers on a tremendous scale, there can be little relief for private business in its needs for capital. If governments fail to take their financial obligations seriously and fail to use every effort to improve their financial position, what can be expected of individual business men?

Governmental Indebtedness

The burden of national debt of the world is appalling. In terms of normal exchange the total debts of the nations of the world were estimated in 1914 at $43,889,000,000; in 1920 they were estimated at $297,604,000,000. Including Russia, the debts of the nations have increased more than eighty-eight billions since the armistice. The burden of these debts can more readily be appreciated when it is known that the interest charge alone, without making any provision for their retirement, is more than twelve billion dollars a year. Furthermore, this burden of indebtedness is growing heavier. At the Brussels financial conference in the latter part of 1920 three out of four of all the nations there represented admitted that their expenditures in 1920 exceeded their income. This, of course, makes it necessary for these governments to come into the market for capital in competition with private individuals.

The Scarcity of Capital

A retarding influence which is closely related to the one just discussed is the scarcity and high price of capital. In the United States the average interest rate during 1920 for prime two-name, sixty to ninety day commercial paper was 7.35 per cent. Since 1857 this average yearly rate has been equalled or exceeded in only '65, '67, '69, '72, and '73. That it is expected that capital will be in great demand for some years is indicated by the fact that long term well-secured bonds are being freely offered to yield from 7 to 8 per cent.

Borrowing has been steadily growing more expensive. In January and February, 1919, the yield of twenty-one selected public utility bond issues ranged from 5.30 to 7.20 per cent, while in January and February, 1921, the yield on bond issues of similar character was from 7.10 to 8.15 per cent. Two years ago the Illinois Central Railroad sold an issue of 15-year bonds on a basis to yield 5.34 per cent; this year similar issues of the Pennsylvania R.R. and the Chicago and Northwestern R.R. were sold to yield 6.58 per cent.

The demand for capital cannot be gaged except as it is indicated by fluctuation in the rate of interest. The demand arises from three main sources: (1) Governmental bodies including national governments, state bodies, and other civil divisions; (2) corporations and similar business concerns whose securities are offered to the public; and, (3) individual business men and small concerns who rely chiefly upon private advances from local banks and from personal acquaintances. The possible demands of the last group for any future period cannot be determined. The requirements of the first two groups can be forecast to some extent by an examination of the amount of securities maturing in a given period and by a comparison with the securities issued in a corresponding period of previous years. To a great extent the securities which mature in any given period are refunded by new issues, and therefore a knowledge of the amount of the maturities will throw some light upon the amount of capital which will be required during the period under consideration. The figures for the new capital raised during a given period in the past are of value only to the extent that there is assumed to be a more or less constant demand for such new amounts of capital. This assumption is not to be accepted without very considerable reservation. However, with this confession of the inadequacy of the data, it may still be profitable to get what information such figures may give us. The following table presents the totals for the United States of the demands for capital including the demands of foreign governments but not including United States Treasury financing as represented by treasury certificates of indebtedness now amounting to about two and one-half billion dollars. Nor do they include the private borrowings of the individual business men. The table presents the totals for the first two months of each year.

	Refunding	New Capital	Totals
1919	$172,704,501	$380,189,819	$552,894,320
1920	112,862,598	653,950,082	766,812,680
1921	120,646,875	593,937,602	714,584,477

Huge as these demands for capital may seem, they would be very much larger if the interest rate—the price for the use of capital—were not almost prohibitive. It is a matter of general knowledge that the railroads of the United States alone could use several billions of capital advantageously if they could obtain it. The same situation prevails in other parts of the world. The transportation systems of most of the countries of Europe have fallen into sad dis-repair because of the lack of capital to use for upkeep and development purposes. Furthermore there are countless industrial establishments shut down entirely or operating under very limited production, which await the energizing influence of an adequate supply of capital.

Most of the depressing influences which have been discussed above will be removed only after the capital supply of the world is augmented. A "readjustment questionnaire" circulated by the United States Chamber of Commerce which was answered by upward of five thousand firms in various parts of the United States elicited the reply from a great majority that one of the most important measures of relief from the present business depression is a lower rate of interest. Some of the largest concerns in the country say they will enter upon no business development until money is cheaper. But there is no royal road by which the supply of capital can be increased and the rate of interest be thereby reduced. The supply of capital can be maintained and increased only by producing and saving.

Thrift is required as much from governmental bodies as from private individuals; as a matter of fact governments should set the example to their citizens by par-

ing expenditures to the bone. Governments, as well as individuals, should consume only what is absolutely necessary so that out of current production may be accumulated the capital with which to repair the ravages of war and to provide for further industrial development.

Interest in Thrift and Industry Helpful Influences

In spite of the impressive list of influences which are retarding business recovery there are others which are helpful. The first of these is a growing conservatism and a reawakened interest in thrift and industry. The widespread speculation in securities and commodities has given place to caution; careless and inefficient management which gave no thought to leaks and waste has been supplanted by more careful attention to possibilities of economy in operation; the reckless buying of all kinds of commodities which was not deterred but was rather stimulated by ridiculously high prices has been succeeded by the so-called "buyers' strike" and the indifference of workmen to the requirements of their jobs is being replaced by a desire to "make good" and to hold the job in the face of possible competition from the ranks of the unemployed. This change of attitude is the result of the changed industrial situation and will be in turn the cause of improvement in this situation.

Increase of Deposits in Mutual Savings Banks

Tangible evidence of increased thrift is to be found in the growth and progress of mutual savings banks in the United States. The year 1920 set a new record in this respect. The total deposits in mutual savings banks on December 31, 1920, were $5,535,389,904. This was a gain of $474,760,885 over 1919. The figures for the average balance per depositor in the mutual savings banks in New York State were, on December 31, 1920, $663.36 as compared with $619.77 the preceding year. In connection with these figures it must be remembered that the early part of 1920 was still witnessing extravagance and expenditure on a great scale; it was only during the latter half of the year and especially during the last few months that the bulk of the people began to practice economy. It is therefore likely that 1921 savings will show considerable gain over 1920. Indeed the reports of the United States postal savings system show a marked gain for the first two months of 1921 over 1920.

The question as to the adequacy or inadequacy of the supply of capital is a relative one. The same volume of capital might be ample under certain conditions and scanty under other conditions. Supply cannot be considered apart from demand. While the supply is now being slowly augmented the demand has been falling off somewhat for two reasons. The lower price level makes unnecessary the use of so large an amount of capital to carry on a given industry; and the slowing up of business activity has either eliminated forcibly or scared off many of the persons who were previously seeking part of the supply.

A second influence, and one upon which most persons base their hope of revival, is the potential new construction. A tremendous amount of construction is in prospect throughout the world. This includes railway and highway building, industrial and housing construction. In the matter of dwelling houses alone in the United States, it is estimated that the shortage at the end of 1920 was 1,250,000. We normally build from 350,000 to 400,000 family dwellings annually. In 1919, however, only 85,000 and in 1920 only 65,000 were constructed.

However, it must be noted that comparatively little of this construction can be carried on until the costs of building decline and until capital is provided in much larger volume. The railroads in the United States have halted much required construction because they are unable to sell their securities in sufficient amount even at the prevailing high rates of interest. In spite of our recognized need for dwellings there is little activity in providing them. The F. W. Dodge Company's review of building and construction activity during February, 1921, estimates the new contracts awarded north of the Ohio and east of the Missouri rivers at $100,789,000, as compared with contracts for $216,663,000 awarded in February 1920. The same influences which are hampering construction on a large scale in this country are operative to a much greater extent in practically all other countries. There is a tremendous amount of work to be done but it waits upon the accumulation of capital. Some observers put the amount of capital needed for construction work in the United States at from $15,000,000,000 to $20,000,000,000. As this capital is provided we may look for revival in construction activity.

A solid foundation for the restoration of prosperity is being laid by the agricultural and extractive industries. Raw materials such as coal, iron ore, copper, rubber, oil, wool, cotton and silk are in large supply, while grains and other foodstuffs are available in larger amounts than at any time in the past few years. The outlook for the coming crop year seems to be very promising in practically all parts of the world.

Two other favorable features deserve note. The Federal Reserve system is functioning in a highly satisfactory manner, and it may be expected that as the pressure of government requirements is relaxed, considerations of a more strictly banking nature will prevail in a manner to increase its usefulness. With the Federal Reserve system in satisfactory operation it may be expected that the banking resources of the United States will be conserved so that they may be mobilized and used in furthering business revival as rapidly as the accumulation of capital justifies.

Finally, it is noteworthy that increased attention is being given to the collection, analysis, and dissemination of business statistics. If all business men were correctly informed as to the trade and industrial outlook and governed their actions accordingly, industrial depressions would occur more rarely and their severity would be greatly modified. Therefore as economic analyses are more generally used to guide industrial development it may be expected that fewer false steps will be taken and that the restoration of normal conditions will thereby be hastened.

Effective Production

The foregoing analysis of economic conditions indicates that there are certain obstacles in the way of a return to normal, the chief of which is the necessity for more effective production throughout the world. There are three important influences hampering production: (1) Instability of prices; (2) inefficiency of labor; (3) shortage of capital. Until these are removed there can be no solid and permanent improvement, though there may be temporary spurts of activity in certain lines of production. Prices have been tending downward, and in some cases are down near the normal level. Those

industries whose products have most nearly reached their normal price level will suffer less from subsequent readjustment than those whose products are still overpriced.

The chief influence needed to furnish an impetus to industrial revival is an increased supply of capital. From the very nature of the present situation no great increase in the stock of capital can be obtained except by the slow, painful process of labor and economy. Hence, real recovery is not likely to be effected this year and the process may even be spread over a number of years.

But already, progress toward partial recovery is being made; productive efficiency is increasing and saving is becoming popular. As these two tendencies become more pronounced improvement in business conditions will be more in evidence. If we do not allow ourselves to be misled by surface appearances we will realize that business conditions are better today than they were a year ago. And from this time onward, although improvement may be slow, and reactions in some industries are certain to occur, general conditions are likely to be better rather than worse. The most significant fact upon which to fix attention in endeavoring to predict recovery is the rate of interest for long time loans. As this rate declines business will improve.

Insuring the Safe Shipment of Machinery

Letters from European Agents and Importers Show Their Appreciation of the Need for Careful Packing

SOME months ago we published an article under the above title in the *American Machinist*, to direct the attention of shippers of machinery to the importance of careful packing. The article was so well received that we sent reprints of it to a number of the bigger European agents and importers to get their reaction to the ideas expressed.

Many of the replies received were rather guarded in their statements, indicating that the writers were unwilling to say anything in criticism of their American clients, but it was quite plain that they were fully in accord with the spirit of the article. A few of the less guarded letters follow, the names of the companies being omitted for obvious reasons:

Referring to your letter of the 24th regarding your article on the boxing of machinery for foreign shipment, we quite agree that the best results can be obtained by following this matter up persistently through your medium, as naturally the American manufacturers will always accept any recommendations which are published in your paper.

We have been receiving some American shapers recently which were packed in such a manner as to assist the breakage of the machine rather than to protect it during transit. The cases were so constructed that the joists were placed cross-ways to the machine rather than parallel so as to assist the taking of the weight where the heaviest stress was encountered, with the result that on all the shapers we received the feet were broken in the same place.

Another point which should be brought out is that while the manufacturers always very carefully mark the cases "top" and "bottom" in English and French, their packers through carelessness sometimes put these marks on in the reverse direction, that is, "top" for "bottom" and "bottom" for "top," and we have received machines under these conditions which have been coming over all the way upside-down.

However, we must say that for some considerable time all our largest manufacturers have given considerable time and trouble to the question of packing, with the result that the machines which we are now receiving all appear to be packed in first-class condition, and it is evident to us they have expended time and thought, as well as money, in devising cases of such a nature that they are absolutely impervious to all shocks received in transit.

Should you feel disposed to publish this letter we are naturally only too pleased to give you our authorization and thank you at the same time for having an opportunity of expressing our views through your medium.

* * * * * *

We duly received your favor with which you were good enough to send us a copy of your article entitled "Insuring Safe Shipment of Machinery."

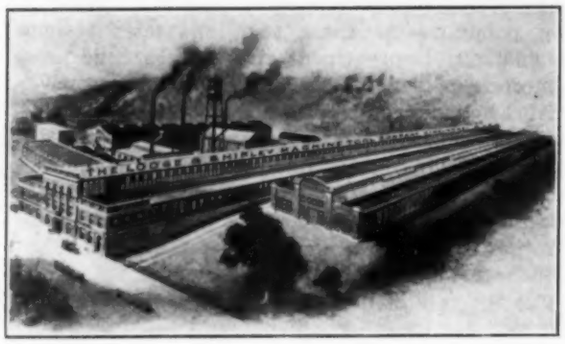
This article is certainly very opportune and we are sure that it will be of assistance to us if only American manufacturers from whom we purchase will profit by the information and suggestions contained in same.

We have certainly had our share of trouble through breakages caused in transit owing to inefficient packing for shipment and we are inclined to think that it would benefit all parties concerned if firms—whether dealers or manufacturers—that have to ship machinery abroad would adopt a method of packing that has proved from long experience to be perfectly satisfactory.

* * * * * *

We are in receipt of yours of the 24th and note your remarks in regard to the packing of machinery. In writing you further, while we have no objection to your using our name if necessary, we would prefer that you did not publish it. We would, however, say that from our experience the use of holding down screws and bolts should be avoided, and that the machine hould be securely fastened within its frame work by timber put so that any slight variation in the frame will not cause these pieces to become loose and will allow a slight movement without danger of breaking the casting, and at the same time prevent the machine from moving about within these limits under any conditions of reasonable handling which they may have to endure. In some cases attention is wanted to the cover of the bright and working parts, although generally the firms we do business with have dealt with this part fairly well.

The third and most important part is that complete packing lists and foundation plans, etc., together with instruction books for the operator where these are supplied, should be inclosed without fail. This has caused so much trouble that we are inclined to think it would be better if these were sent to the agent or importer direct so that they could be handed to the proper party. All machines should be properly adjusted before they are packed and if any parts are to be removed for convenience of packing, etc., these should as far as possible be removed in units, so that when the units are put back in place all the separate parts in the unit will be properly adjusted. Handles and handwheels, where there is any danger of them coming in contact with the case, should all be removed and packed in a box inside the case. We often have had experience of a case in the handling having had some of the covering boards removed, and while there has been no particular damage to the machine itself, handwheels, etc., have been broken and screws bent. In many cases this would not have occurred had handwheels been removed. The object in view should be that the machine should reach the custimer in exactly as good a condition as it left the manufacturers. No concern likes to have a new machine arrive broken and knocked about and we know from our experience that those concerns which have troubled to study packing have attained this end satisfactorily, and we wish you success in getting the same results from all concerns.



A Monitor-Type Shop for Building Lathes

Construction of Roof Prevents Freezing Difficulties—Good Light in All Places—Convenient Benches for Assembling

BY FRED H. COLVIN
Editor, *American Machinist*

IN BUILDING its new shop No. 3, the Lodge & Shipley Machine Tool Co. selected a monitor type of building, but instead of having straight sides on the monitor, or having the roof high in the center, the monitor sides are slanting and all roof drainage is toward the center of the building. Among the advantages are the increased amount and better distribution of light, and also the elimination of drainage difficulties in cold weather. Where the drainage is toward the center, all the drain pipes come inside the shop where they are never cold enough to freeze, so that all the annoyance and disadvantage due to that source is eliminated. This is true of the drainage of the monitor roof as well as of the roof over the side bays, drainage from both roofs coming into the same upright pipes beside the columns as shown at the left in Fig. 1. This view gives an excellent idea of the way in which the light is distributed, the combination of the high side-windows on the monitor and the long windows on the side of the shop resulting in a uniformity of lighting on which it is difficult to improve.

The effect of an abundance of unobstructed daylight in a machine shop can hardly be overestimated. The men do better work and more of it; there are fewer mistakes, fewer accidents and of course less cost in electric light bills and lamp maintenance. Then too there is an undefinable and perhaps unmeasurable something about the place that gives added vigor and enthusiasm and that helps in more ways than we are apt to realize. The exact construction is shown a little more clearly in Fig. 2, which shows the shop to be 90 ft. wide, the width being equally divided among the three bays. The side bays are 14 ft. high in the clear and the clearance below the crane bridge is a trifle over 9 ft. The center bay is 26 ft. high and the top of the crane rail is 19 ft. 3 in. above the floor. As indicated by the outline of the cranes shown, the left-hand bay has one 4-ton crane, the center bay one 15-ton crane and the right-hand bay two 1-ton cranes. The roof construction and the use of concrete both for the flooring and the wall foundations are clearly shown.

FIG. 1. THE INTERIOR OF SHOP NO. 3

The general layout of the shop is shown in Fig. 3, the dimensions being approximately 90 ft. wide by 535 ft. long. It was primarily built to accommodate the erection of machines and to contain the engineering department, the restaurant and kitchen, as well as the tool storage which will be referred to in another

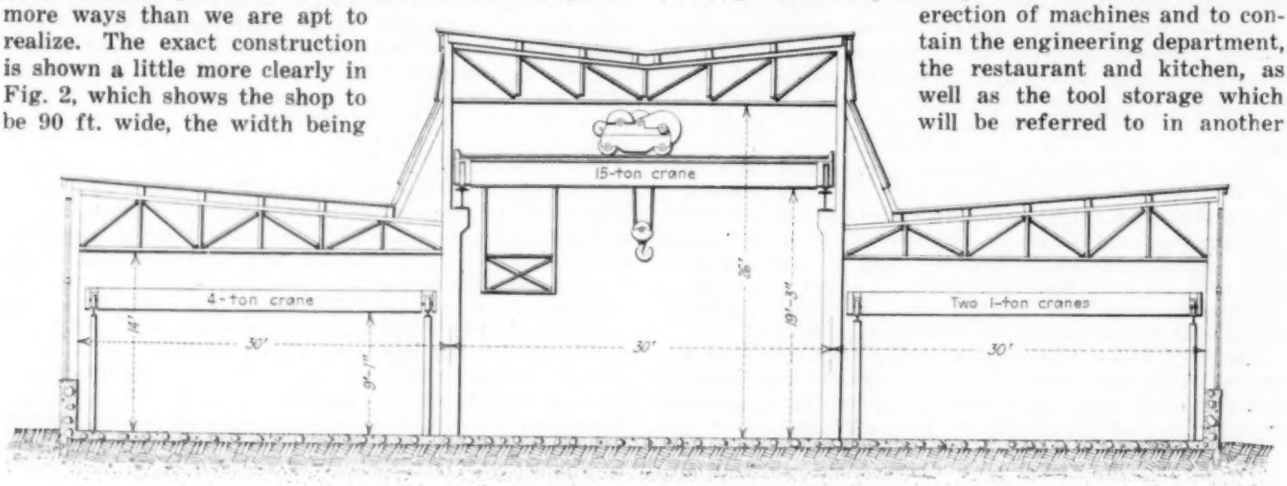


FIG 2. CROSS-SECTION OF SHOP

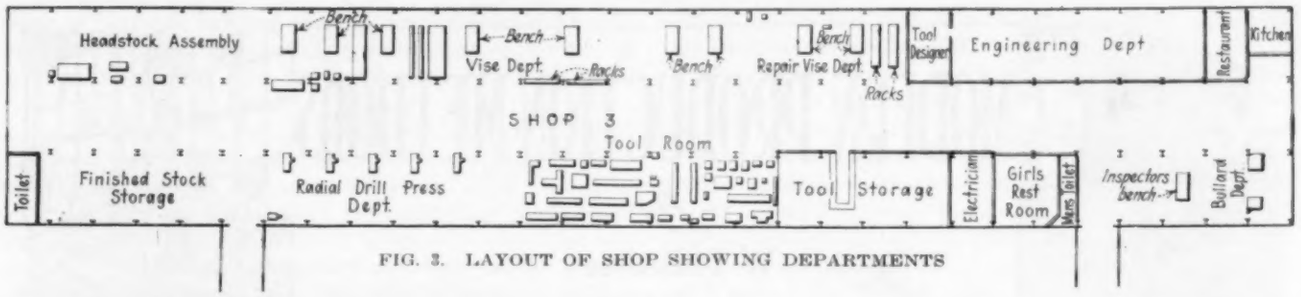


FIG. 3. LAYOUT OF SHOP SHOWING DEPARTMENTS

FIG. 4. THE ASSEMBLING DEPARTMENT, SHOWING LOW BENCHES

article. The toolroom adjoins the tool storage and, as can be seen, has quite an extensive equipment for manufacturing such tools, jigs and fixtures as may be necessary.

It will be noted that the toolroom occupies considerable space and also that it is well equipped with machinery. Its convenience to the tool storage (which will be described in another article) is also an advantage particularly in securing such repairs and adjustments on tools and fixtures as may become necessary from time to time.

The assembling benches in the vise department are particularly convenient, as can be seen in Fig. 4. They are considerably lower than the usual standard height, and are of large size, 6 x 12 ft. This view also shows the small vise benches for erectors and the racks for finished pulley and other units at the right. The lighting is excellent, as can be seen. The wall in the distance separates this department from that for tool designing.

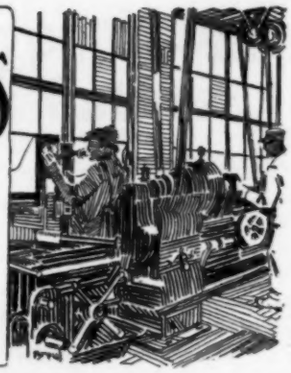
The engineering department is next to the tool designing room and is shown in Fig. 5, where can be seen the excellent daylight lighting and the profuse equipment of incandescent lamps for use at night. At the right is a large drawing board on which new machines are drawn full size so as to get a correct idea of their proportions. This view also shows the type of drawing tables used, the highback chairs and other conveniences for the draftsmen.

The heating of the shop is by hot water but instead of depending on gravity for the circulation, the water is forced through the radiators. This method has been found to be much more economical than the hot air system in use in the older buildings.

FIG. 5. IN THE ENGINEERING DEPARTMENT

MODERN PRODUCTION METHODS

By
W R. Basset
of
Miller, Franklin, Basset & Co



XVII. Handling Abnormal Expense

Making Monthly Adjustments in the Accounts to Take Care of Fluctuations—Normal and Abnormal Expenses and Costs

SUPPOSE you own a shop able to turn out 200 lathes a month. Suppose that, normally, the overhead expense runs $10,000 a month, or at the rate of $50 per unit of output.

Along comes a business depression and the orders fall off so that it is doubtful if you can sell even 100 lathes a month. The plant runs half time. You will at once cut down on some items of overhead which can be made to follow roughly, the shop's activity.

But there are some items of the overhead, such as the fixed charges and, very likely, the salaries of the superintendent and other executives, which are uncontrollable. You can not very well cut them in proportion to the falling off in output. If you are careful perhaps you can cut the overhead of your plant to around $8,000. Each lathe you make will then have to carry $80 of overhead. That means that your product costs you more when orders are hard to get than when business is good. If you attempt to get back your actual cost, you must raise the selling price.

But the sales department has little difficulty in convincing you that to get orders enough to fill the plant, the selling price must be cut. It looks like another one of those vicious circles. Just when you need to attract new orders you find that because production is low, your costs are abnormally high. Obviously, if you attempt to base your selling prices on your actual costs you will make it still harder to attract sufficient busi-

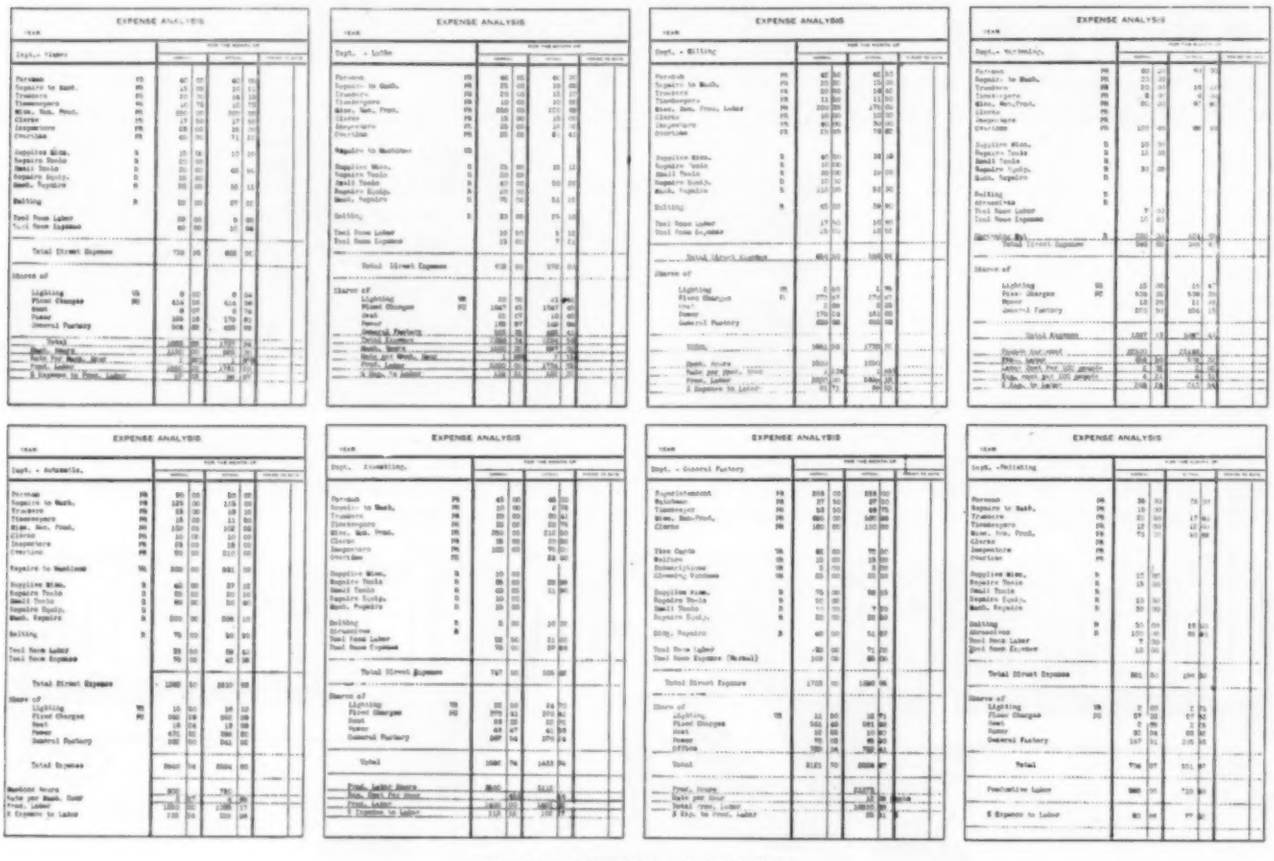


FIG. 82. EXPENSE ANALYSES

ness so that you can get back to normal costs. That is the problem that faces every owner of a machine shop whenever business goes into one of its seemingly periodical slumps.

But in lesser degree the same fundamental problem is present even during times of normal business. The activity of a plant fluctuates somewhat from month to month, reducing the cost of the product a little with extra activity and raising it when the plant is less active. Even with an accurate cost system the executive is puzzled, for he finds that his products turned out in June costs him say $114 each, in July perhaps $121 and in August $117. How is he to price out a product sold, say, in September? He may not be able to tell by then in which month the particular one he is selling was made. And yet the average man, who believes the figures his cost system gives him usually feels that to be consistent he should base his selling price on his actual costs.

This shortcoming of cost systems led me, some twelve or more years ago, to search for a solution. The "normal and abnormal cost" plan which has since been quite generally adopted by competent cost men, is the result.

It does several things for the manufacturer. First it gives him a standard cost which is the cost of the product when the plant is normally active. This does away with the bother of considering the day to day fluctuations in actual cost. Second, it enables him intelligently to go after needed new business at a price which will get the business, and at the same time bring back a certain known part of the actual cost. Third, it does not penalize the factory for high cost of production which is really due to business conditions or poor selling. Fourth, it sets up a budget figure not only for each department of the plant but for each item that makes up the overhead of each department. This gives the executive a quick control when the actual expenditure for an item overruns the budget or normal figure, and it shows him just where expenses may safely be cut when business falls off.

Let us see, in detail, how normal expenses are arrived at and used. The first step is to determine the normal activity of the plant. Presuming that the shop has been put in balance, as described in Part VI, when we were considering the planning of production, it is apparent that for one-shift operation the maximum is 100 per cent of the machine capacity. Actually we find that this is seldom attained, for the sales force does not always make enough sales; production planning may not be perfected; machines will break down and men will sometimes lay off. Research shows that 80 per cent of capacity is a fairly high normal activity for machine shops. Of course, if the plant operates two shifts of equal length we have a possible capacity of 200 per cent when we speak—as is customary—in terms of a single shift.

If a plant is unbalanced, one or more departments may regularly work overtime. One such, for which we developed costs, operated 10 hours a day except one department which regularly worked 6 hours overtime. This department's capacity was thus 160 per cent of a single shift and its normal activity was 80 per cent of 160 or 128 per cent.

In this way we determine for each department its normal activity expressed in productive hours whether of machines or men.

Next, we must develop a dollars and cents' figure for the normal expense of each department. This is based on the history of actual expense for a period of normal activity if it is available. If, however, such a history is not to be had, it is possible to build up accurate normals. Since a description of this method will cover all problems which can be encountered we will consider that we are developing normal figures for a shop during the slump in the fall of 1920.

The expense analyses for this shop have been developing the actual items of expense for, say, two or

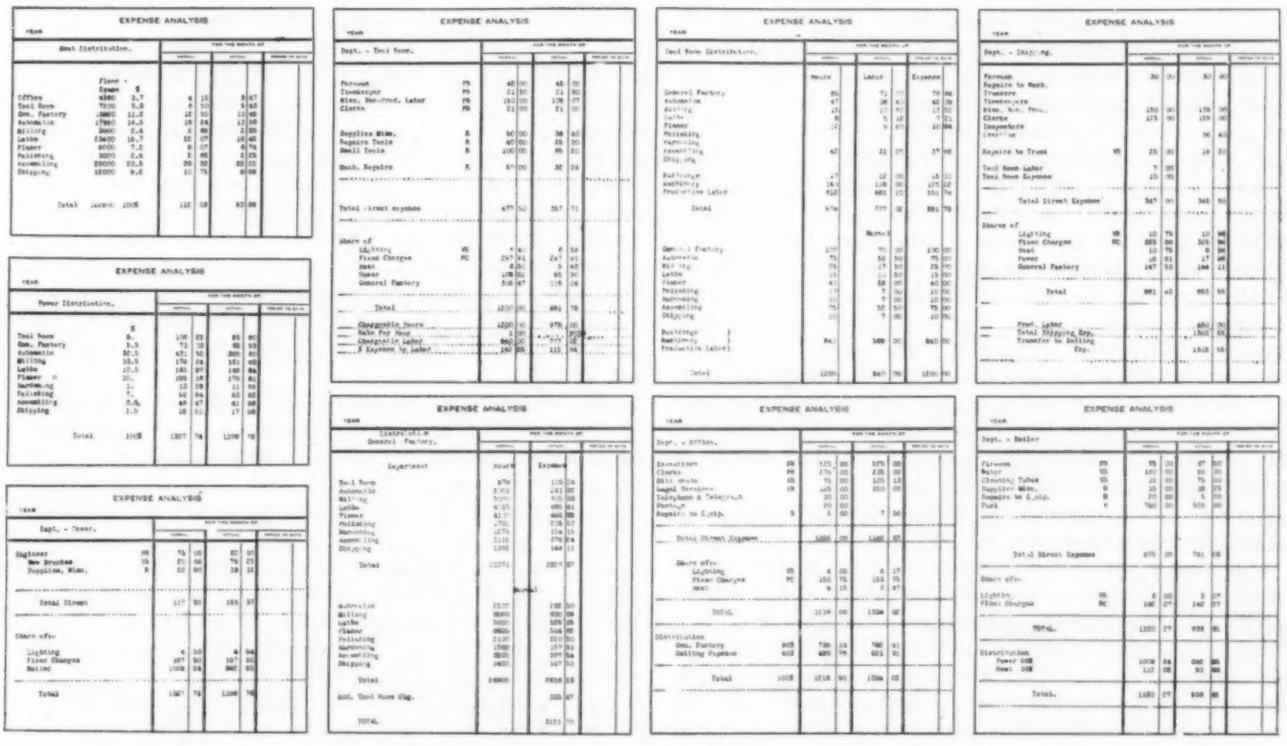


FIG. 82. EXPENSE ANALYSES (CONTINUATION OF)

three months. The figures came from the sources of original entry and we have described how they are carried forward through the contributory departments into the productive departments.

In setting normals we therefore examine each actual item on all of the expense analyses and, in the light of our knowledge of the shop and its problems, we determine what would be a reasonable amount for each item to be at normal—that is 80 per cent capacity—production.

Take the general factory department. The first item shown in Fig. 82 is superintendent's salary, $225. The superintendent is a key man who will not be dropped and his salary will not fluctuate with the shop's activity. As we do not contemplate changing his salary at present, the actual figure becomes the normal. The same conditions apply to the watchman whom we must keep on the payroll whether the plant is on full time or shut down.

REPORT OF ABNORMAL EXPENSE

NAME	MEASURE OF PRODUCTION	ACTUAL PRODUCTION	ACTUAL EXPENSE	ACTUAL RATE	NORMAL RATE	NORMAL EXPENSE	DEVIATION FROM NORMAL GAIN	DEVIATION FROM NORMAL LOSS	
TOOL ROOM	MACH. HR.	612	551.70	.90	1.00	612.00	60.22		
AUTOMATIC	MACH. HR.	750	352463	4.69	3.270	2452.50		1072.13	
MILLING	MACH. HR.	1050	1739.30	1.657	1.234	1295.70		443.60	
LATHE	MACH. HR.	897	2234.56	2.358	1.586	1785.24		511.32	
PLANER	MACH. HR.	325	1737.56	1.875	1.420	1430.50		239.44	
HARDENING	100 POUNDS	251.30	1087.63	4.310	4.210	1040.84		24.79	
POLISHING	LABOR	710.30	551.37	77.6%	80.06	568.67	17.30		
ASSEMBLING	LABOR HR.	3112	1453.74	.46	.452	1406.62		27.12	
TOTAL			12320.77			10678.07	77.52	2320.22	
			10678.07					77.52	
NET LOSS			2242.70					2242.70	

JOURNAL ENTRY		DR.	CR.
GOODS FINISHED & IN PROCESS		10678.07	
MFG. EXPENSE			10678.07
PROFIT & LOSS DUE TO ABNORMAL EXP.		2242.70	
MFG. EXPENSE			2242.70

FIG. 83. REPORT OF ABNORMAL EXPENSE

But the next item, "timekeepers," is controllable. Under normal conditions two timekeepers are needed, but as production for the period we are reviewing was slack, but one timekeeper was needed. Our budget for normal operation however, must provide for two, so we put our normal figure at double the actual as shown for this month. Miscellaneous non-productive labor fluctuates almost directly with the activity, and we know that when normal conditions come again, this item will go up. We estimate that $695 will be the expense for non-productive labor normally. The normal or budget figure for clerks is arrived at in the same way.

As we have already seen, some of the overhead items do not vary with the activity of the shop. An example is window cleaning. For such items the normal and actual are the same. Other items fluctuate more or less directly with the shop activity. For the month in question there were, for example, no tool repairs requisitioned, but month in and month out we find that this item amounts to about $50 a month, so that figure is decided upon as normal.

The amount of power used will vary with production, but the share of fixed charges will not.

In setting up the normal expense for the toolroom, we are again confronted with the situation of the toolroom bearing a charge from the general factory, and also with the toolroom giving a charge to the general factory. To overcome this difficulty, a fixed figure is used on the toolroom for the general factory amounting to $305.47, and, in making the distribution of the general factory expense, after the total normal expense has been determined, the amount that we have charged to the toolroom is deducted before making our distribution to the other departments. The amount is not used in calculating the percentages which we used for purposes of distribution to the departments of the general factory charge.

After the normal figures for a department are settled upon, they are totalled and distributed to the productive departments in exactly the same way as are the actual figures. This has been described in Part XVI.

The normal or standard rates of expense for the productive departments are developed as they were for the contributory departments. The total normal expense for a productive department is divided to give a normal rate per hour by using the standard expense and the standard hours. If a department's expense is applied as a percentage of expense to labor rather than on the hourly basis, that figure is developed by estimating the total wages that will be normally paid in that department.

This standard or normal expense rate is the figure used in costing the product. This gives an apparent discrepancy between the expense which has actually been incurred and the standard expense. The difference must be taken care of in the accounting. It is easily and accurately done.

There are two ways in which this adjustment can be made. You may recall that during the month we put into the "goods finished and in process" account of the ledger, the productive labor that was actually expended during the month. We also charged to this account the materials drawn from the different inventory accounts, and the total manufacturing expense.

This account is thus charged with the actual cost of the finished goods on hand, and of the unfinished goods in process which are scattered throughout the plant. This actual cost may be high or low, depending upon the activity of the plant for the past few months.

While we have here the total actual cost of a large number of different parts in different stages of completion lumped together, it is apparent how nearly impossible it would be to determine the actual cost of any given part, for they started at different times and went through under varying conditions of shop activity.

And yet these parts, as one by one they are sold, must be credited to the goods finished and in process account at cost. We can in the end take out of this account no less or no greater amount than has been put into it.

Here is where the standard cost is of great advantage, for it saves useless hair-splitting and clerical labor, while giving at the same time complete accuracy. For we credit the goods finished and in process account with the normal cost of those articles which have been sold.

Suppose that during one month the actual overhead expense for the planer department had been at the rate of $1.05 per machine hour, or $2,100. This sum has been charged to the goods finished and in process account as described in previous articles. Suppose that normally the expense of this department is $2,200, or at the rate of $1.10 per machine hour. This is the rate at which goods sold must carry the overhead absorbed

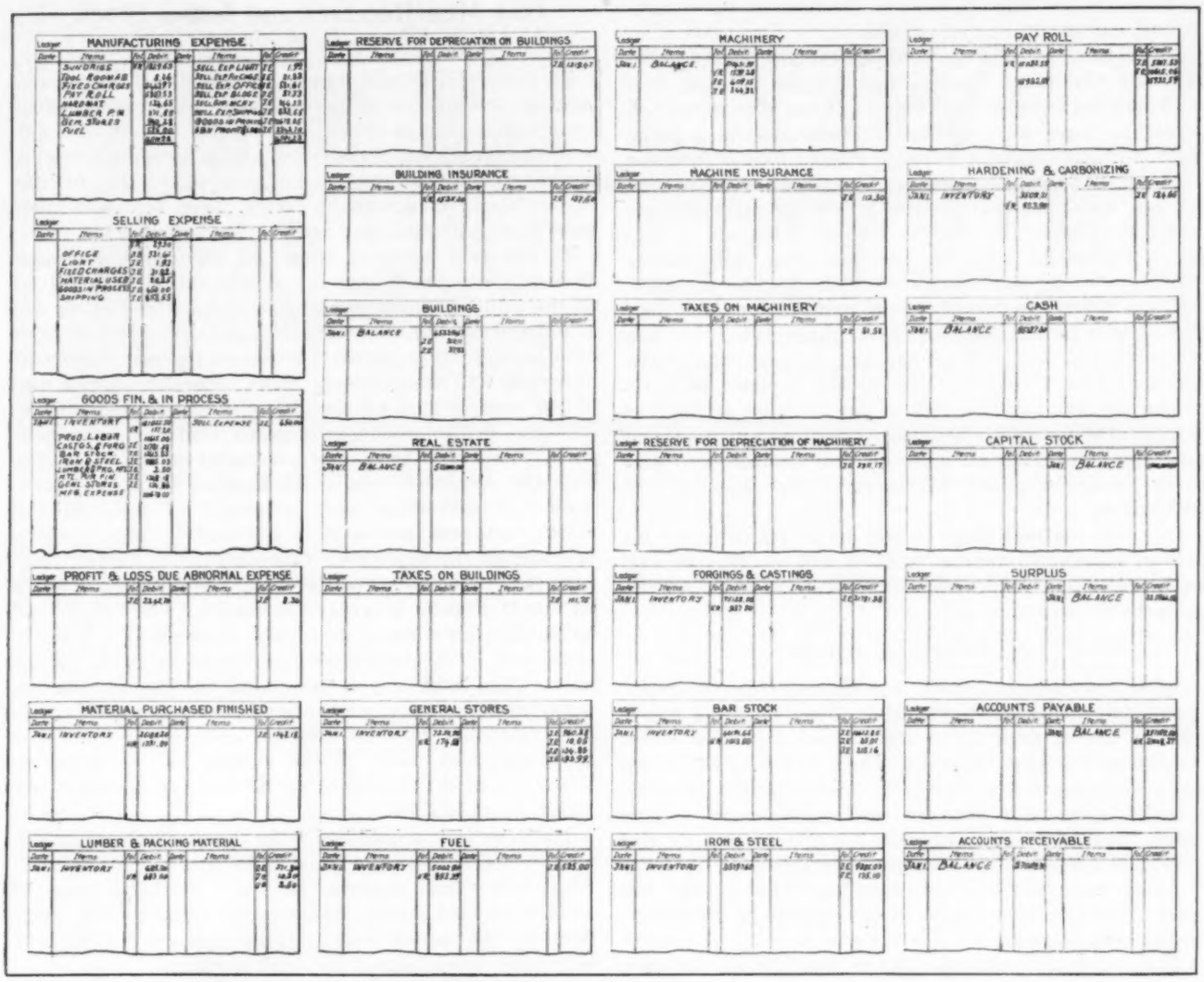


FIG. 84. ADJUSTED LEDGER ACCOUNTS

by them as they go through the planer department. If we credit "goods finished and in process" with the cost of goods sold at the normal rate, it would result in taking $100 more out of the account than was put into it. No conceivable activity of this account can result in a profit to it; yet a profit shows up here. It is due to the increased activity of the planer department.

So we make an adjustment between the "goods finished and in process" account and an account called "profit and loss due to abnormal expense" to take care of the $100 discrepancy. The result is to add $100 to the goods finished and in process account. It is done by the medium of a journal entry, charge "goods in process" $100 and debit "Profit and loss due to abnormal expense." If the shop had operated below normal so that the actual machine hour rate had been $1.15, the journal entry would read, credit "goods in process" and debit "profit and loss due to abnormal expense."

Some cost engineers and managers prefer to make the adjustment directly between the manufacturing expense account and the profit and loss account. There is little to choose between the two methods. If the latter is done we credit the manufacturing expense account with the amount of the normal expense as it is developed for the month, and charge this amount to the goods finished and in process. The difference that now exists, either debit or credit, in the manufacturing expense account is charged or credited as the case may be, to "profit and loss due to abnormal expense." In this way, "goods finished and in process" are kept at a normal base of expense. So when goods finished and in process are relieved by the cost of sales figures at standard rate of expense, there will be no discrepancy in the goods finished and in process account.

If after a period of several months, there is found a persistent discrepancy in the same direction between actual and normal rates, it is advisable to set up new normals. When the normal method is first started it frequently occurs that incorrect normals have been set up, due to insufficient information to go on. Or conditions in the plant may change to a degree. In a period of rapidly rising wages and salaries such as occurred in 1916 to 1919 it may be found that the actual expense persists above the normal. That condition might require that the normals be frequently and carefully revised.

We are showing here in Fig. 83 the building up of the adjusting entry for the difference between the expense actually incurred and the expense as figured at the normal rate on which we base the cost. By referring to this exhibit you will see that it gives the executive at a glance, those departments which have run over or under the predetermined rate of expense and by a

reference to the expense analysis because of this shortcoming, can easily be determined.

The normal method of handling expense solves automatically the much mooted question as to how idle machine time is to be distributed. It has always seemed unfair to have any particular piece absorb a large amount of accumulated expense due to lack of use for the tool on which it is made. Certain charges run on irrespective of whether the tool is busy or not. Neither is it fair to make the shop as a whole take care of this cost, loading the cost for the idle time onto pieces which are in no way connected with the idle machine. The lost time on a machine is a straight business loss. Handling it in this way sets the figures up so that the executive may see at a glance any deviation from the standard rate. By referring to the expense analysis he can see whether it is due to low machine activity or to increased expense. Cost figures throw up their own warning. The expense analysis provides an easy and quick means by which to ascertain the cause of the fluctuation.

In a few unusual shops it may be desirable to set up standards or normal costs for labor and material as well as for expense. The method of handling would be the same in principle.

Inventory Adjustment

Some accountants object to adjusting the inventory and the profit and loss monthly. They say it is incorrect to take a profit or a loss before a sale is made. My thought is that the main object is not to effect the profit and loss, but to normalize and hold the goods in process figure at a common or normal figure, at the same time absorbing the losses on materials as the materials are used. If, by good management, the cost of labor, materials or expense is less than normal, the profit is obviously a profit to the month in which the transaction occurs.

The normal or standard figure that is set for each item of expense on the expense analysis is in effect a budget. The executive who watches the expense analysis to see that the actual expenditures do not exceed this figure has an effective control by which to keep overhead from running away with profits. After an estimate has been made, it is important to make sure that the actual items of expense do not exceed the figures on which the estimate was based. It is more important to know, for instance, that machine repairs in the automatic department are costing $100 a month more than we estimated they should cost, than to know that some minor part is costing two cents more than we figured on our estimate.

In this article are shown the expense analyses, Fig. 82, complete, with normal and actual figures, just as they go to the executive who has a fully functioning cost system. We also show the ledger accounts, Fig. 84, adjusted to take care of the profits and losses due to abnormal expense. It will be noticed that these ledger accounts as previously shown carried no balances from previous inventories. They were purposely ommitted to avoid possible confusion in tracing the later entries. From now on we have to take these balances into account, so we have interpolated them.

When a cost system shows only that a part is costing more than the estimate, it is simply bringing us bad news. With normal and actual figures for expense side by side, we may still get the bad news, but we are shown where to go to stop the loss.

One Man Receives and Issues Stock

By Peter F. O'Shea

In certain sizes and kinds of industries the record making, so valuable in most circumstances, becomes so complicated that dependence upon the human element is simpler and less expensive. As a general thing it might be said that the limit of size where this is true is a two-man department; for if there are more men than this, they need the records for information.

In the raw material stores of the Likly Luggage factory, however, it was found that one man could do all the actual physical work of receiving and picking out raw material. Besides himself a clerk or two had been used in keeping inventory records on the maximum and minimum and exact balance basis. The stores man was of the opinion that he could do the job himself and do it right if the inventory records could be dispensed with. This was tried and succeeded so well that the company saved the considerable expense of clerical work.

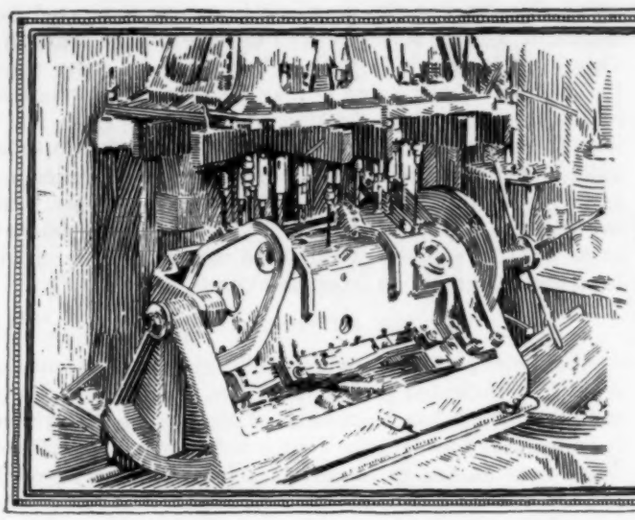
On the arrival of each shipment of material the stores caretaker enters it in a receiving report which is made out in duplicate. One copy on a manilla page remains in the receiving register. The top copy is made on a buff page as large as the register, but subdivided by perforations into four separate tickets, 5 x 8 in. in size. One of these tickets is a complete receiving report. The buff copies are sent to the purchasing department as an announcement that the material has been received, and then they are returned to the stores clerk who files them by the number of the material. When the material is used up he removes his receiving report from his file.

He is so well acquainted with the stock that he ordinarily does not have to consult the file, but can tell offhand how much material he has. The quantities of material issued are of course on job tickets which come first to the stores man. From the job tickets the quantities are analyzed for cost purposes.

If this man were absent from work for a very long period a new man could be broken in only with difficulty by personal attention from the superintendent; but the contingent cost of this is much less than the current cost of keeping up the old records.

Under this simpler system the single stores man not only does the complete job but he also has time to take care of product coming to the repair shop of the company. He receives this material just as though it was raw material, except that he makes out a separate register. This gives source from which the product was received, quantity, size, style, description, condition in which the goods were on arrival, and instructions as to what is to be done with them; with a reference number to the credit memorandum issued to the source. This register is made out in two copies. One is retained by the stores clerk who also handles the goods when they are repaired and ready to be shipped.

The second copy of the report on returned merchandise is on thick manilla cardboard, 6 in. wide by 12 in. long. The top part is the same as the other copy. The bottom part consists of two work ticket coupons which are torn off along the perforations. One of these goes to the workman, the other is retained by the foreman of the repair department. They specify the name of the workman, time taken, piece price and the amount of wages. The top of this card has a little eyelet so that the card can be hung on the "work ahead" hook of the repair department.



Tool Engineering

By
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Drill Jig Design Continued—Templet Jigs—Plate Jigs—Open Jigs for a Shaft—Open Jig for a Pump Cover—Closed Jigs

IN THE previous articles we have taken up a number of points in connection with the design of drill jigs. We shall now apply some of the principles which have been described. It is not our intention to apply every principle or each mechanism which has been mentioned, but rather to give a few examples of jigs of various types to illustrate the general procedure in jig construction. From the examples given the tool designer can note various features of importance and by careful study he can doubtless see other ways in which the same piece of work can be jigged. As a matter of fact the studious designer will find it to his advantage to consider each jig shown and endeavor to handle the work in as many different ways as he can, applying the principles which have been carefully explained in the preceding articles.

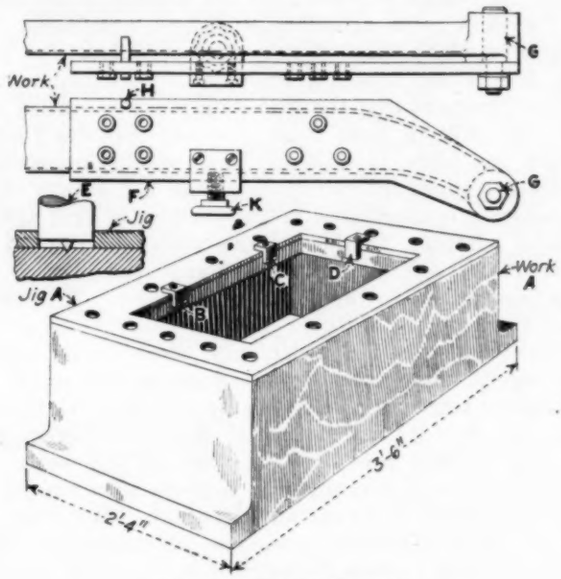


FIG. 69. TEMPLET JIGS

As explained previously, the templet jig is the simplest form that can be made. In elementary form it is sometimes nothing more than a thin plate of steel with holes located to suit the condition. This plate is often set on the work and marked with a prick-punch or scriber. Templet jigs of this kind would be made up only in cases where there were a dozen or so pieces to be drilled and also when the location of the holes did not require very great accuracy.

Going a step further in the design of templet jigs let us consider the ones shown in Fig. 69. The work *A* is a cast-iron frame of large size; there are a number of holes to be drilled on the upper surface, and there are only a few pieces to be machined. In order to drill these cheaply and to have uniformity for the various pieces, the jig *A* is made up of sheet metal and is furnished with three locaters shown at *B*, *C* and *D*. The templet is placed in the position shown and clamped in place by some convenient method, using the locaters to bring it into the correct position. The holes are then prick-punched with a punch similar to that shown at *E*, after which the templet is removed and the work drilled according to the locations marked.

Another templet jig is shown at *F* in which the work is an automobile frame. The hole *G* in the front spring hanger is used as one locater for the jig and the pin *H* acts as the other stop against the side of the frame. This jig is a little more elaborate than the one previously shown as it is furnished with a thumbscrew at *K* to clamp it in position. Jigs of this kind may be furnished with bushings if desired, or they may be used with a prick-punch to locate the holes before drilling, as in the previous instance. It is evident that this type of jig could be made much longer and carried farther along the frame to allow for the drilling of the other holes if necessary. A method of using a templet jig is shown in Fig. 70, the work being shown at *A* and the jig at *B*. Let us assume that the

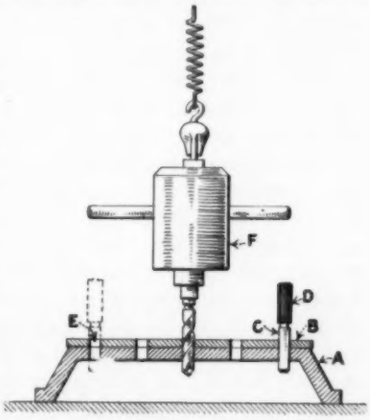


FIG. 70. USE OF A TEMPLET JIG WITH LOCATING PLUG

For the authors' forthcoming book. All rights reserved.

templet has been clamped to the work and that one hole has been drilled at *C*. A convenient method of making sure that the templet does not shift, is to use a plug like that shown at *D* in the first hole drilled. After this another hole can be drilled at some distance away as at *E* and a second plug inserted after which the remaining holes can be drilled without danger of disturbing the location of the templet. An electric drill, indicated at *F*, is convenient for work of this sort.

Plate Jigs

There is a strong family resemblance between plate and templet jigs, yet there is a distinct difference, in that the plate jig is often used for high production while the templet jig is never used except when production is small. There are many cases where a large piece of work requires a few holes to be drilled accurately in relation to other holes which have been previously bored and reamed and it may frequently prove to be more economical to design a plate jig than to attempt to do the work in a very large jig in connection with other holes. An example of this kind is shown in Fig. 71, in which the work *A* is a large casting which has been machined on the base *B* and on the upper surface at *C* and in which the holes *D* and *E* have been bored and reamed. It would not be economical to make a large jig to drill the holes at *F* and *G*, especially as it is necessary to locate them in relation respectively to the reamed holes *D* and *E*. It will be found more economical to make up a plate such as that shown at *H*, which has bushings provided at *F* and *G* and which locates by means of the studs *K* and *L* in the reamed holes. It is evident that a large jig of this sort would need nothing to hold it in place as it would be quite heavy. Therefore a handle is provided at *M* by which to lift it off the work after the drilling has been done. Jigs of this kind are in common use in many factories.

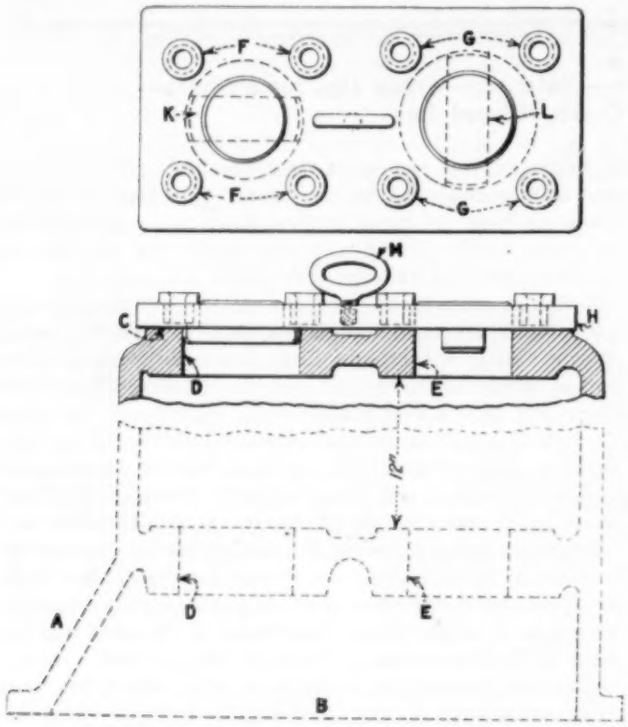


FIG. 71. PLATE JIG FOR A LARGE CASTING

In Fig. 72 is shown another application of a plate jig which, like that in the previous instance, is located by means of a stud *A* in the center hole of the work *B*. This stud is provided with a key at *C* in order that the location of the holes *D* may be in a given relation to the keyway. The location of the holes *D* is such that it would be difficult to support the work properly unless particular provision were made. In order to assist in drilling, a support *E* is made up of cast iron so that the work rests on it. There are occasional cases where a support of this kind may be used in order to avoid designing an expensive jig.

Jig for a Dovetail Slide

A simple plate jig, which will give very accurate results, is indicated in Fig. 73. The work *A* is a dovetail slide which has been finished all over and in which it is necessary to drill the four holes shown at *B*. These holes must be drilled in correct relation to the dovetail and it is therefore necessary to locate the plate jig in the dovetail slide as indicated. The jig is provided with a binder at *C*, operated by a thumbknob *D*. The binding member is so made that it fits a circular recess in the plate and it is evident that this forms an excellent clamp to hold the plate in position. The end location of the jig is obtained by means of the stop-screw shown at *E*.

Open Jigs

In the design of open jigs the general construction of the work to be drilled must be first considered. As a general thing jigs of this kind are made for work which does not have a great depth. Occasionally they are so arranged that the whole jig must be turned over and the drilling done from the side opposite that in which the piece is loaded. This usually necessitates drilling against the clamp and while not always objectionable, it is considered better practice to drill against a solid surface. In the example shown in Fig. 74 the piece of work *A* has been previously reamed at *B* and has been milled on the surfaces marked *f*. It is necessary to locate the work so that the hole *C* is in a fixed relation to the hole *B* which must therefore be used as a locater. The work is set up on a stud at *B* and clamped by means of a swinging C-washer *D* through the nut *E*. It will be noted that the C-washer is pivoted so that it will swing clear of the work. By making the washer in this way loose pieces in the jig are avoided, which is always an advantage. The other end of the work is located under the bushing *C* by means of the sliding V-block *F*, operated by means of bayonet-lock and screw-bushing shown at *G*. This construction allows for variations in the boss on the work at the point *C* and at the same time a quarter turn of the knob *H* releases the V-block and allows it to be pulled back sufficiently so that the work can be removed from the jig. There are many cases where this construction is extremely valuable as it permits rapid action and the mechanism is at the same time simple and easy to manufacture. This is a very good example of an open jig for a piece of high production work and the principles illustrated can be applied in numerous cases.

Open Jigs for a Shaft

Fig. 75 shows an open jig of excellent construction. The shaft *A* has been completely machined before the work is drilled. It is necessary to locate the drilled hole *B* at 90 deg. from the keyway in the taper at *C*. The work is placed in V-blocks and located against

the stop *D* at one end. The sliding member *E* is arranged so that it will locate in the keyway. A cam lever shown at *F* is used to clamp the work. The clamp is so made that it bears at *G* and *H* simultaneously. A slot at *K* allows it to be slid back away from the work when loading or unloading. A suggestion is made in regard to the construction of the pin at *L*. Two methods can be used, the one shown in the drawing being the cheaper. The enlarged view at *M* shows an improved method which is more substantial but also more expensive. The designer must be governed by the size of the stud at *L* and if it is found that the pin is not sufficiently strong to withstand the pressure of the cam lever, the improved construction *M* can be used. A jig of this kind is rapid and its operation makes it very convenient to handle.

The jig shown in Fig. 76 is an open jig which, however, is close to the border line between the open and closed types. The work *A* is a pump cover which has been machined on the surfaces marked *f*. It is to be drilled at *B*, *C*, *D* and *E* in this operation and it is necessary that these holes should bear a correct relation to the outlet *F* as well as to the previously machined surface and also to the outside diameter of the work. The method of locating the piece is rather out of the ordinary. The casting rests on four hardened bushings directly under the holes *B*, *C*, *D* and *E* and the spout *F* is located against the hardened locating pin *G* through the action of the bevel spring plunger *H*. It is also given another location, with respect to its outside diameter, by contact with the locating pins *K* and *L*, which are fixed in the body of the jig. After

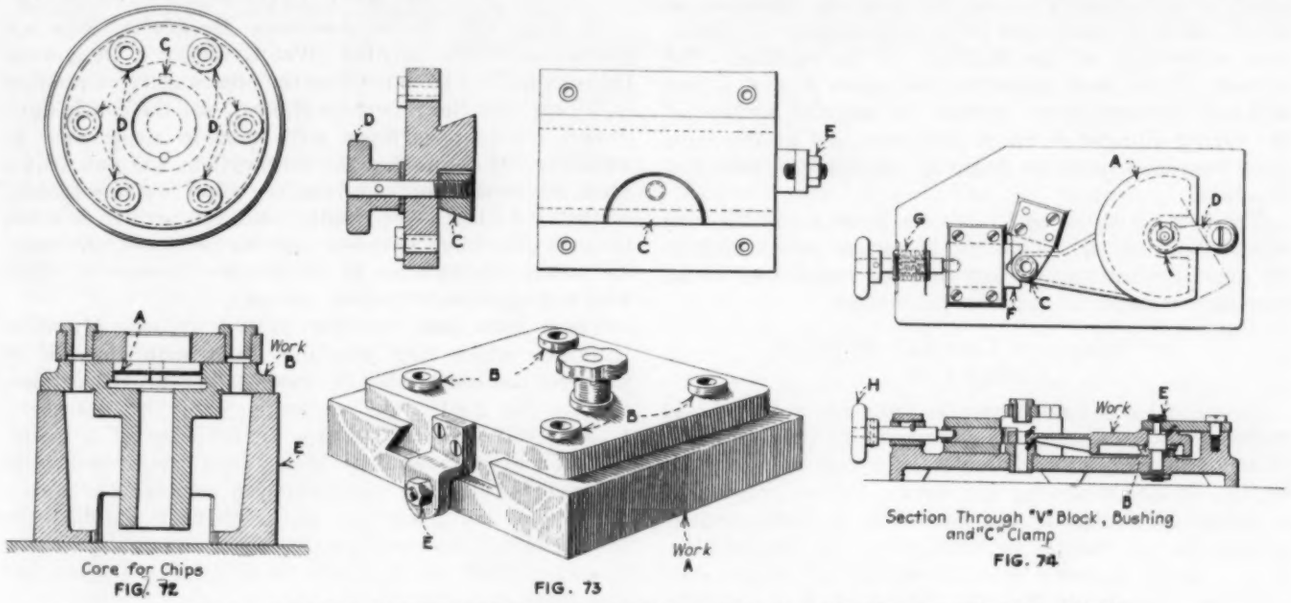


FIG. 72 FIG. 73 FIG. 74

FIG. 72. PLATE JIG WITH ACCESSORY SUPPORT. FIG. 73. JIG FOR A DOVETAIL SLIDE.
FIG. 74. OPEN JIG FOR A LEVER ARM BRACKET

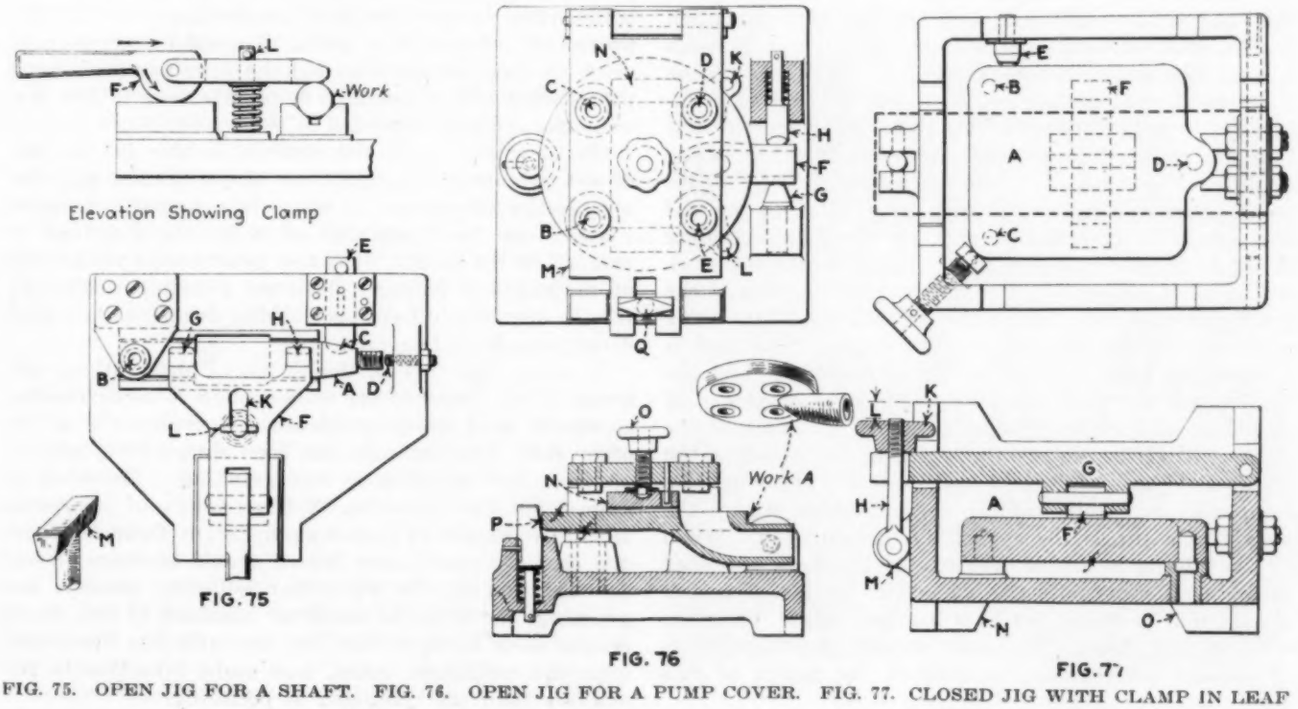


FIG. 75 FIG. 76 FIG. 77

FIG. 75. OPEN JIG FOR A SHAFT. FIG. 76. OPEN JIG FOR A PUMP COVER. FIG. 77. CLOSED JIG WITH CLAMP IN LEAF

the operator closes the lever *M*, when the work is in position, the clamp *N* is screwed down on the work by means of the thumbscrew *O*. It will be seen that this clamp is not directly above the locating bushings on which the work rests, yet there is no danger of distortion on account of the stiffness of the casting. The portion of the work opposite the points *K* and *L* and mid-way between them, strikes the angular surface of the spring plunger *P* which depresses and at the same time insures a positive location against the two pins *K* and *L*.

The locking of the leaf is by means of a quarter-turn screw shown at *Q*. This jig is rather exceptional in its general construction and may be considered as an excellent example of modern jig design.

Importance of Chip-Clearance in Closed Jigs

In closed jig design particular attention must be paid to the clearance around the work in order to have plenty of room for chips to accumulate, for cleaning, and for setting up and removing the work. Wherever possible in closed jig design it is a good idea to core openings in the side of the jig in order to allow for cleaning. A very good example of a closed jig of simple construction is shown in Fig. 77. The work *A* is a casting which has been finished at *f* in a previous operation. There are three blind holes to be drilled at *B*, *C* and *D* and it is necessary to locate the work from the finished side of the casting, from the boss around the hole *D* and to provide another locater which will come in contact with the rough casting on the side as indicated at *E*. In the design of the jig it is well to note that the stud *E* could be so made that it would be adjustable, but in this case it has not been done because the casting is known to be a good one and not subject to variations at this point. The boss around the hole *D* locates in an adjustable V-block, the construction of which has been mentioned in a previous article. The work is clamped in position by means of the screw at the corner adjacent to the hole *C*. It is advisable to set this thumbscrew at an angle of 10 or 15 deg. so that the action will tend to force the work down on the finished surface *f* as well as to carry it into its correct location. The work rests on the heads of the three hardened bushings at *B*, *C* and *D*. These bushings are slightly different from the regular type in that they are counterbored slightly to allow for chips while drilling. The method of clamping the work is by means of an equalizing clamp *F*, which is mounted in the leaf *G*. Attention is called to the fact that the clamping action is not directly over the points on which the work rests, but it can easily be seen that the thickness of the casting is such that there is little likelihood of its being distorted by the pressure of the clamp. The leaf is clamped by means of the swinging eyebolt *H* and the thumbknob *K*. Care must be taken to allow plenty of clearance at *L* so that there will be no chance that the screw will strike the drilling-machine table before the leg does. The eyebolt is so made that it will not revolve completely on account of the end *M*, which strikes the wall of the jig as the eyebolt is thrown open. When in use this jig is turned over so that the work is drilled from the side opposite the leaf. The jig feet *N* and *O* should not be made too long as they might interfere with the drill chuck. There are several important points of general construction involved in the design of this jig.

Wet Grinding a Dangerous Occupation—Discussion

By Alan A. Wood

On page 825 of the *American Machinist* there appeared an article entitled "Wet Grinding a Dangerous Occupation." I have not had the opportunity of reading in its entirety the report mentioned, but the conclusions drawn seem at variance with modern experience in grinding. It seems that the observations were all drawn from one town, from one industry and from one factory in that industry. Apparently, also, comparison is made between the rough grinders and the polishers, obviously an unfair one because of the greater amount of stock which the grinders have to remove.

There have been brought to the writer's attention instances where dry grinding, even with the aid of properly designed exhaust systems, has proved intolerable to the health and convenience of the operators. I can recall such an instance in the case of a manufacturer of electrical machinery and the trouble was rectified by properly equipping the machine for water. By proper equipment for water there is implied the protection of the operators, not only from the actual drops or splash which might fly off from the wheel but also from spray or mist.

This brings up another point in connection with the article, namely, that the workers were accustomed to remaining in their wet working clothes for several hours after leaving the mills. It is obvious that if the machines were properly guarded the clothing of the workers would not be in this condition. There are some grinding operations in which it has always been the habit of the operator to sit close to large revolving sandstone wheels and almost in the path of the water. Happily this class of machinery is being superseded by more efficient modern machines designed to protect the operator as well as to turn out a satisfactory quantity of good work.

In the case of the grinding of non-ferrous materials such as baked clay, carbon, stone, etc., dry grinding even with exhausters is almost intolerable. The dust which rises is very fine and penetrating and the only protection seems to be a mask. The exhausters seem to catch the heavier particles but the finer particles, more penetrating and apparently more injurious to the system, may remain suspended in the air for hours.

On the other hand, the reverse is true in the case of wet grinding; although some of the heavier particles may escape the stream of water in a properly designed system, the finer particles of dust are dissolved or "killed" by the spray. It is also unnecessary in the case of modern and properly designed grinding machinery for the operator to have his clothing dampened by either direct splash or fine mist.

It seems that this particular set of observations outlined by Dr. Drury is not wide enough to be conclusive, especially since the preponderance of evidence is on the other side. The tendency has been almost invariably to go from dry grinding to wet grinding. Therefore it seems that the attention of the readers of *American Machinist* should be drawn again to Dr. Drury's report and that the conclusions drawn should be more closely defined; that in this particular industry, namely, axe grinding, and with the machines available at this plant, results seem to show that the wet grinding operation, with the conditions noted, was more injurious to the workers than the operation of polishing.

The Rolls-Royce Connecting Rods

Rods Finished All Over—Both Hubs Same Length for Ease in Holding—Continuous Bearing on Crankpin—Floating Piston Pin Bushing

By FRED H. COLVIN
Editor, *American Machinist*

IN COMMON with the other parts of the Rolls-Royce motor, there is considerable material allowed for finish on the connecting rods in order to be sure and remove any minute surface cracks that might exist in the original forging. In the case of the connecting rod, which is finished all over, the weight is greatly reduced and there are fifty operations. Fig. 1 shows some rods in several stages of completion.

The machining begins with rough drilling the small hole, after which the rod is heat-treated so as to test to a Brinell hardness of 293 to 321. When the test shows the correct hardness, the test piece forged on the rod is notched, broken off, and tested to insure the material being suitable in every way. Then the rod is sand-blasted and the first side milled with a slabbing cutter, this operation being followed by a similar milling of the second side. Both of these surfaces are then ground on a Blanchard machine as they are used for the future working faces.

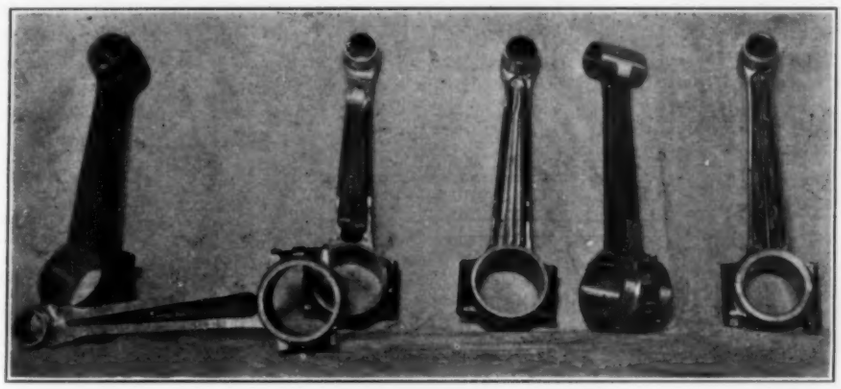


FIG. 1. THE ROD IN VARIOUS STAGES

It is interesting to note in this connection that both ends of the rod are made of the same length so as to be easy to hold in all milling and other fixtures without the necessity of having a step or pad of special height under the large end of the rod. When all the milling has been done the two sides of the large end are faced to their proper length by a simple and efficient method. This makes it possible to produce rod after rod with the boss faces in parallel planes.

Boring and Milling

After the surface grinding, both ends of the rod are bored and reamed on a Bullard boring mill as shown in Fig. 2. The method of holding the rod is unusual. The large end is centered sideways by two jaws, one being shown at *A*. These jaws are actuated by a right and left hand screw at *B*, and bear on the bolt bosses. The screw *C* centers the small end and the straps hold the rod in place. After this operation the edges are milled on an Osterlein milling machine. Then the sides of the flanges are rough- and finish-milled and the radius of the large end form-milled. The outside of the large end is hollow-milled or turned with a 3-deg. angle, after which both sides of the small end are hollow-milled in the same way. Then comes the rough- and finish-profiling of the small end and the flange approach, followed by the rough-milling of the channel on each side.

A special device has been designed and built for finish-milling both sides of the channel in the Garvin duplex milling machine shown in Fig. 3. The fixture carrying the rod is moved lengthwise of the rod and at the same time moved vertically so as to follow the proper contour by means of suitably located cams concealed in the base of the fixture. The object of this compound motion is to secure a continuous movement of the rod with relation to the cutter so as to avoid even the slightest undercutting at any point, due to the cutter revolving while the rod is stationary. For, although such undercuts or depressions are too small to be easily measured, they are known to be excellent starting places for incipient cracks and every contingency of this kind is to be avoided where possible.

Next comes the milling of the profile on the cap and also the rounded outer surface of the small end and also the annulus in the small end. Bolt holes are next drilled, milled, and the cap spot-faced and counterbored for the bolt head. The tops of the bolt bosses are milled and then the faces are surface ground to the finished width on a Blanchard grinding machine. Grinding the larger bore to the finished size is done on a Van Norman

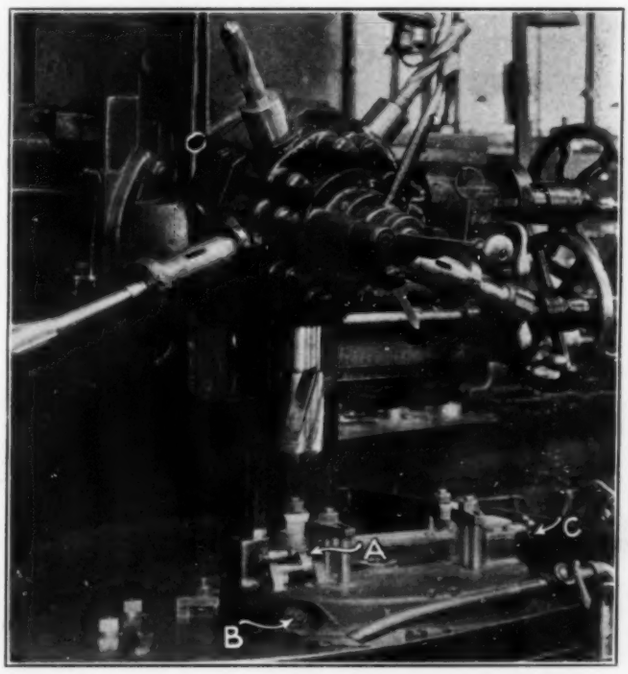


FIG. 2. BORING THE ROD

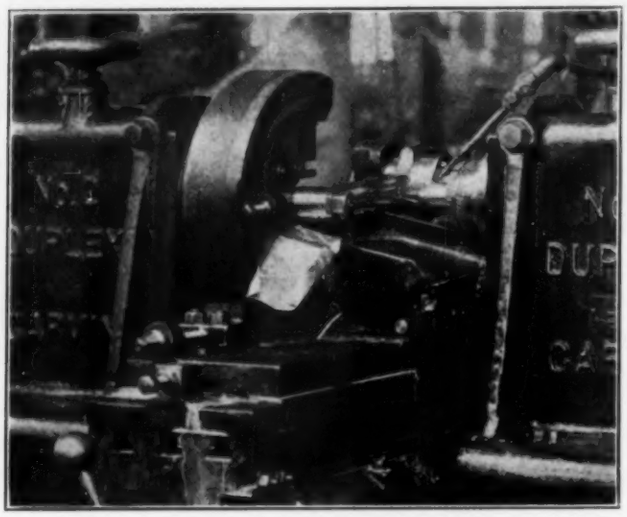


FIG. 3. AUTOMATIC MILLING OF CHANNEL

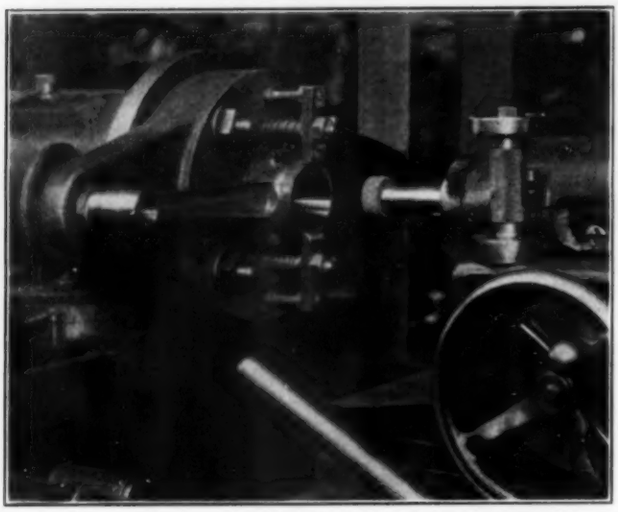


FIG. 4. GRINDING THE LARGE BORE

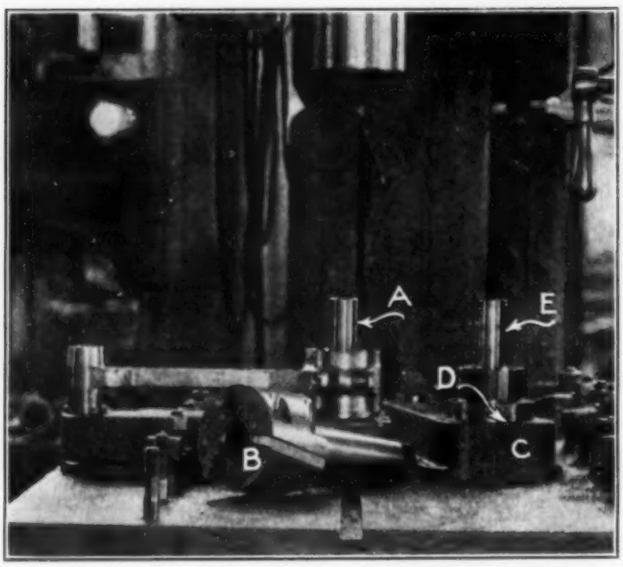


FIG. 5. FIXTURE AND TOOLS FOR FACING LARGE END TO LENGTH

machine, as shown in Fig. 4, the rod being located by the small end and clamped on the special fixture as shown.

The small hole is next ground to the finished size on the same machine but in another fixture, and the sides of the large end are then faced to their proper length on a Foote-Burt machine, using the tools and fixtures shown in Fig. 5. The rod, whose position on the fixture is shown, is suitably centered and held at the large end by a pilot having a projecting plug *A* of a definite length. The facing cutter *B* is not only guided by this projecting plug, but also stopped in its downward movement by this same plug touching the bottom of the hole.

After one side has been suitably faced, the rod is turned over on the fixture shown at *C* in which the collar *D* supports the side of the rod which has been faced off. The same cutter then faces the second side in the same manner, being both guided and stopped by the plug *E*. This method is very simple and has proved to be very accurate and satisfactory.

Next comes sawing the cap from the rod with a cutter 0.187 in. thick. This cutter, however, does not cut clear through but leaves a wall of metal 0.010 in. next to the bore. The rod and cap are given similar indentification marks and are then separated. Holes for the oil pipe are then drilled in both ends as well as the small rivet holes in the channel of the rod for holding the oil pipe in position. These rivet holes are then properly countersunk and the holes in the ends reamed for the oil pipe.

The radii of the flange are next blended into the flange side and the caps are tied to the rod so as to prevent separation while in the storeroom.

All burrs are then removed and the oil pipes and clip fitted. The white-metalled bushes are next fitted to the rod and cap and all the joint faces surfaced. Suitable liners are chosen and the whole assembled. The liners or shims are merely to take the place of the metal removed by the saw cuts, and differ from the usual shims in that they have a bearing-metal face which forms part of the rod bearing, and are reamed with it, so as to form a continuous surface and prevent the escape of oil under the pressure feed system.

The final reaming of the white metal bushings is done in the fixture shown in Fig. 6, where the rod is positioned by the piston-pin hole and the large end swung down into the fixture where it is position-guided (not clamped) by the two arms shown at *A*. The reaming is most carefully done. The bar having some of its cylindrical surface milled away to allow for inequalities of the bore is for properly centering the connecting rod before reaming. No scraping is done to secure a surface. Some rods are reamed to slightly different diameters so as to allow the proper oil film space at each crankpin, provided the difference comes within the manufacturing tolerance allowed.

The fixture for testing the connecting rod is shown in Fig. 7 and is very similar to the usual design with one or two exceptions. The square cornered gaging surfaces on the end blocks gage the alignment of the holes in both directions while the inner block gages both the length of the piston-pin boss and also the squareness of the rod to the large bearing.

It will also be noted that there is a bushing in the small end of the rod. This is of bronze and floats between the rod and the piston pin, which is locked in the piston at each end. It has oil holes drilled through it and is a working fit both in the rod and on the pin. The cap bolts are hollow for lightness.

One of the notable features in connection with this

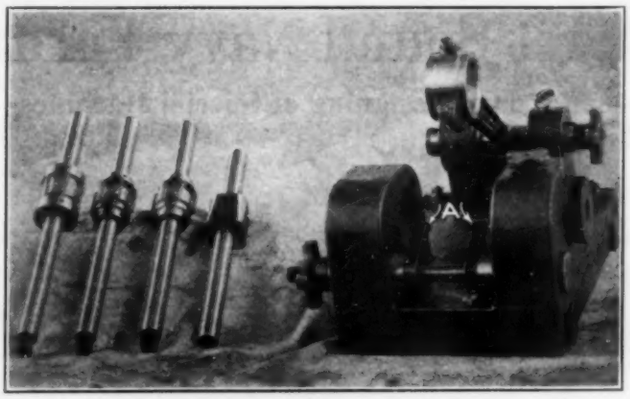


FIG. 6. THE FINAL REAMING FIXTURE

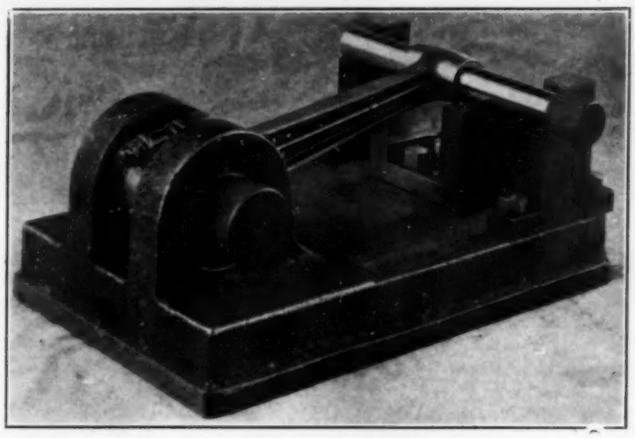


FIG. 7. TESTING SQUARENESS OF ROD

connecting rod is that no provision is made for straightening the rod to bring the two holes in alignment. They are machined with extreme care so that no straightening seems to be necessary. Whether or not the straightening does any harm, if properly done, the management evidently believes in being on the safe side by avoiding it altogether.

The War Work of the Bureau of Standards

It has seemed advisable to gather together in one report, descriptions of some of the more important military investigations conducted by the Bureau of Standards during the war. This is important for two reasons. In the first place it is essential that as complete a record as possible be kept of the activities of the bureau during the period of hostilities; and in the second place, many of the results gained through military investigations are equally applicable and important in peace-time work.

The report consists of short descriptions of the various investigations which were carried out, each description being complete in itself and having no reference to the organization of the bureau or the scientific divisions which carried out the work. It is, therefore, possible to read any one of the sections of the report without referring to any of the others. No attempt has been made to give complete descriptions, and but little data will be found as it was believed better to limit the text of this report to general information and conclusions.

Detailed results of the various military investigations which the bureau conducted will be found not only in the regular publications of the Bureau of Standards, but in the reports and specifications of the War and Navy Departments, and in the material published by such organizations as the National Advisory Committee for Aeronautics. In almost all cases the bureau's war work was carried out in close co-operation with these other organizations and quite frequently the bureau itself issued no reports on the subject.

Subjects Treated

A very large number of subjects will be found to be treated, a few of which are as follows: Aeronautic instruments; aeronautic power plants; aircraft materials and construction, such as the relative merits of wood and metals for building airplanes, the best substances for airplane dopes, etc.; balloon gases, including the work which the bureau performed in connection with the recovery of helium from natural gas; the calibration of testing machines, by which the tests made at various arsenals and munitions plants were referred back to the standards of the bureau; various chemical investigations including analysis of ferrous and nonferrous metals, the development of platinum substitutes, the routine testing of soap, oils, and paints, experiments in connection with the prevention of corrosion, etc. Chromatic camouflage and its detection illustrates the application of scientific work in optics to modern warfare, while the description of the investigation of various processes for cooking inferior grades of coal illustrates the successful co-operation of the bureau with other Government establishments, in this case the Bureau of Mines.

In connection with the building of concrete ships, a new aggregate giving a particularly light and strong concrete was developed. Other parts of the report deal with various electrical subjects, such as batteries for automobiles and trucks, electric generators for setting off high explosives, magnetic methods for detection of flaws in steel, testing of special lamps for signalling purposes, and extremely important work in connection with radio telegraphy and telephony, including the development of the radio direction finder, radio instruments for submarines and the electron tube.

The production and testing of precision gages in various munitions plants was one of the important pieces of work conducted by the bureau and will be found to be briefly described.

Various materials of construction, ranging from metals to leather and rubber, were tested in large quantities and investigations conducted to determine their availability for all sorts of new uses. This work, as well as the more usual testing of structural materials, will be found described in the report.

In connection with the development of various new processes of manufacture in the United States, mention should be made of the work on the production of optical glass, the making of a successful cotton fabric for airplane wing construction to replace linen formerly employed and aid in the development of a satisfactory laminated wood construction for airplane beams. Many other subjects are included in the report, but the above list is typical.

Illustrations are given showing the apparatus employed in some of the investigations and also various representative specimens, from simple devices to complicated machinery, which were tested by the bureau.

Abstract of miscellaneous publication of the Bureau of Standards, No. 46. The complete paper may be secured from the Superintendent of Documents, Washington, D. C.

Turbine Work at the Puget Sound Navy Yard

Boring, Blading and Assembling Ship Turbines—Standard Designing of Special Machines—Cutting Blades and Packing Pieces from Strips

SPECIAL CORRESPONDENCE

AMONG the different varieties of work undertaken at the Puget Sound Navy Yard during the war, was that of building turbines for various ships. The accompanying illustrations show some of the work done on a turbine for ammunition ship No. 1, which was one of the wartime activities of this yard. Fig. 1 shows the boring of the high-pressure turbine casing, this being of comparatively small diameter although requiring a good size floor boring machine for the work. The blading of a casing is shown in Fig. 2. The location of the blades as well as their length can be clearly seen at *A*, smaller and shorter blades being in position at *B*. This view also shows that the section at *B* is cast separately and bolted into position as the casing to be seen at the rear is still minus this important part.

A low-pressure casing and rotor are shown in Fig. 3 with the rotor being lowered into position. The method of handling the rotor by the overhead sling with cables at *A* and *B*, and the guides at *C* and *D*, are of special interest. These guides insure the rotor being lowered straight into position, which is very necessary as it only takes a slight deviation to bring the turbine blades in the rotor into contact with those in the casing and cause excessive damage.

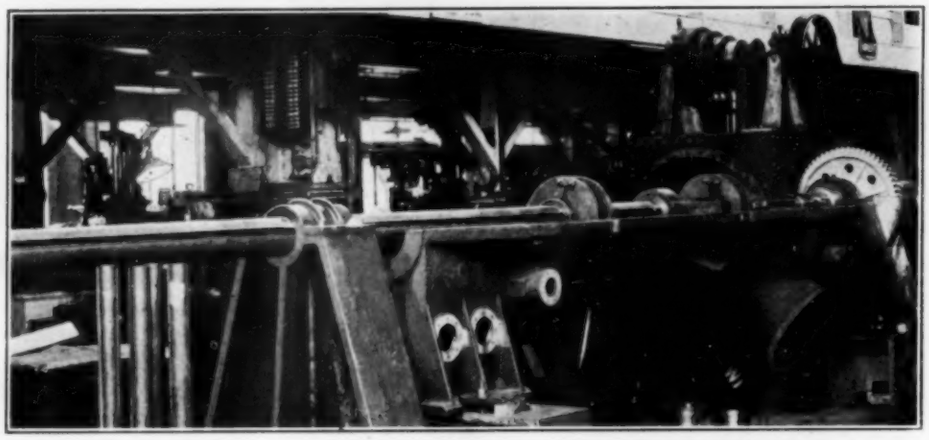


FIG. 1. BORING A HIGH-PRESSURE TURBINE CASING

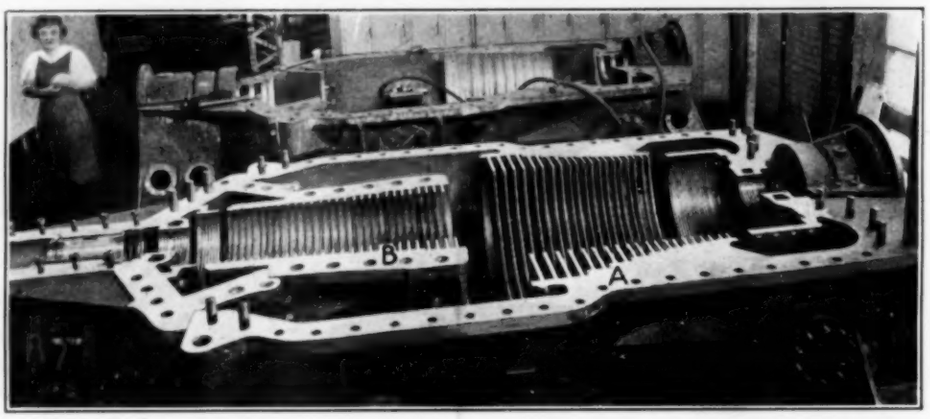


FIG. 2. INSERTING THE BLADES IN A LOW-PRESSURE CASING

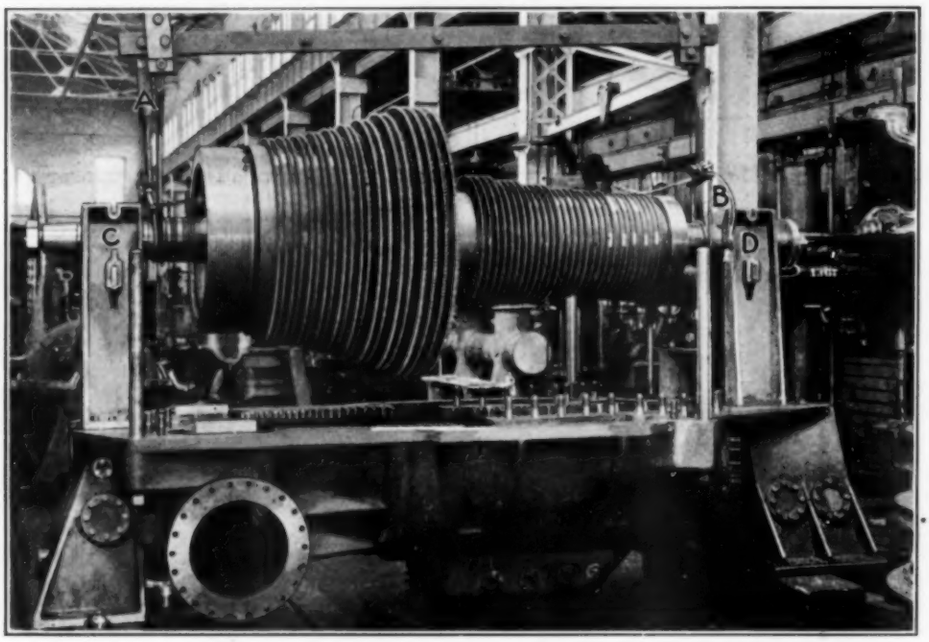


FIG. 3. LOWERING THE ROTOR INTO THE LOW-PRESSURE CASING

Some of the small special machines devised for assisting in the production of turbine blades, are shown in the following illustrations. Fig. 4 shows the small machine built for cutting the turbine packing pieces which go between each of the blades or buckets and space them their proper distance apart.

These packing pieces are cut from a specially shaped bar as can be seen from the shape

of the pieces at *A*. The bar is clamped in the special vise *B*, and fed against a stop to insure the pieces being of the correct length. A forward movement of the lever *C* cuts off a packing piece and the operation can be repeated at a rapid rate. The round key *D* locates the toolblock *B* and holds it in position with relation to the slot in the table, the holding down bolts clamping it firmly in place. Such a key obviates the necessity of special fitting to secure good alignment. In Fig. 5, the turbine blades are being cut off and serrated or notched to fit in their grooves in either turbine casing or rotor. Special drawn stock is used for this purpose in order to avoid as much machining as possible, and the Niagara press shown is fitted with suitable guides both for cutting off and for notching.

A special machine for tipping the turbine blades is shown in Fig. 6. The blades are held in a vertical position as at *A*, the lever *B* being pulled upward by the spring *C* and clamping the blade with the lower end.

A machine for slotting the ends of the turbine blades is shown in Fig. 7.

It will be noted that the machines illustrated in Figs. 6 and 7 are of the same general design, the bases and tables having been cast from the same patterns without alterations.

Designing special machines so that one or more patterns can be used for several different machines indicates a highly commendable spirit on the part of the responsible one.

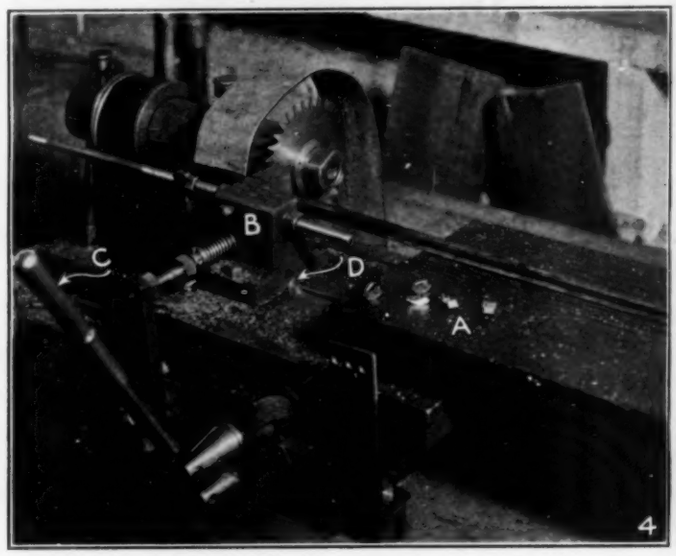


FIG. 4. CUTTING TURBINE PACKING PIECES.

FIG. 5. CUTTING OFF TURBINE BLADES

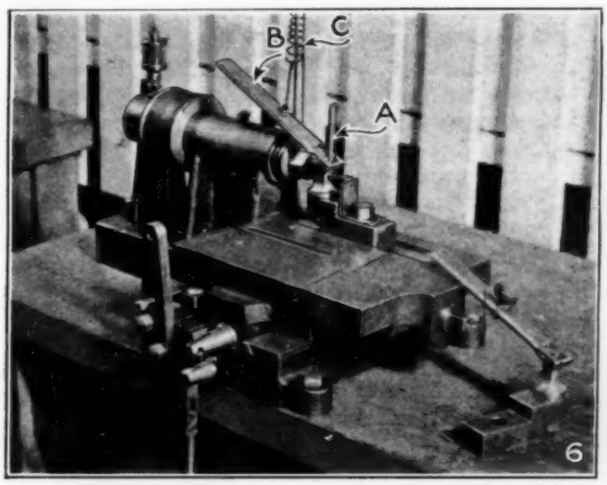


FIG. 6. TIPPING TURBINE BLADES.

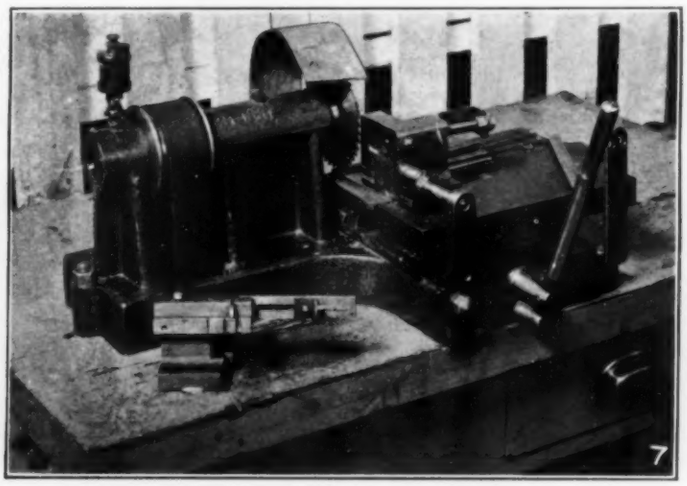
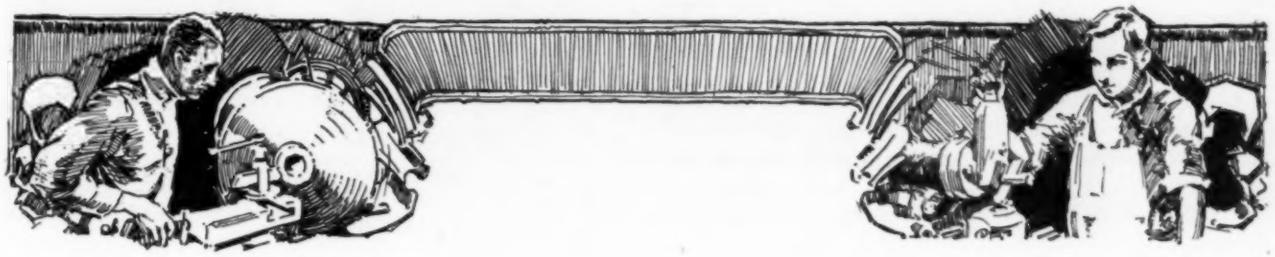


FIG. 7. SLOTTING TURBINE BLADES



Defiance Multiple-Spindle Drilling and Tapping Machines

Single-Purpose Machines—Either Horizontal or Vertical — One or Two Heads — Inclosed Working Parts—Unit Mechanisms—Tunnel Work Fixtures

By J. V. HUNTER
Western Editor, *American Machinist*

THE design of modern drilling machines has been profoundly influenced by the demands for the intensive production of automotive parts. Development has produced the multiple-spindle drilling machine with fixed-center spindles, some of which machines

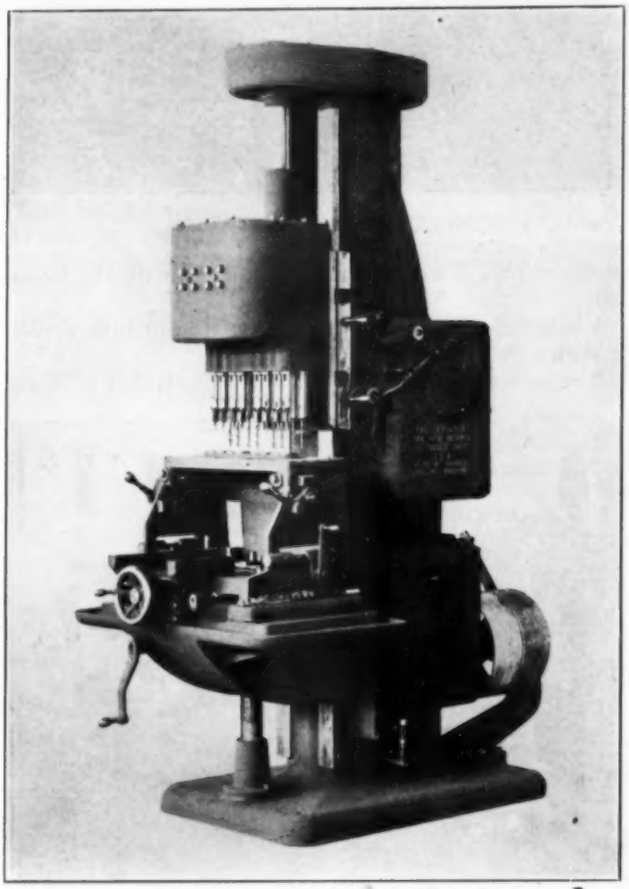


FIG. 1. DEFIANCE 16-SPINDLE MULTIPLE DRILLING MACHINE

are capable of drilling nearly a hundred holes in a single operation.

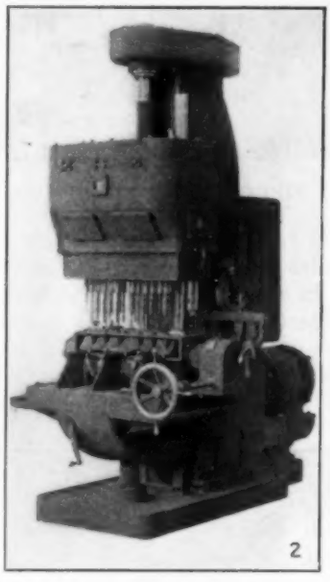
The Defiance Machine Works, Defiance, Ohio, builds a line of multiple-spindle drilling machines, some of the late models being here illustrated. A large share of the machines are of the single-purpose type; but the fact must be borne in mind that by changing the spindle housing and work fixture it is frequently possible to convert a machine to other work of similar character. A vertical drilling machine with sixteen working spindles is shown in Fig. 1.

The machine serves both for drilling and countersinking operations and performs them progressively by making use of a sliding work fixture. In operation, the work is pushed in place along the slides, lowered onto locating spots by turning the lever at the right of the fixture housing, and then clamped in place. The handwheel at the front is used to move the fixture against its back stop, and eight holes are drilled by the rear line of spindles. The fixture is then brought against the front stop and the holes are counter-bored by the front row of spindles.

The base and column are a single casting proportioned to withstand heavy strains. The speed and feed drive-gear mechanisms are housed in separate units bolted to the sides of the column and frame. Square, flat-faced ways are finished on the front of the column for guiding the spindle housing and the work-table. The work-table may be raised and lowered by means of a heavy screw running in a large sleeve mounted on the base, which screw can be operated by a helical gear drive from a handle on the front of the table. So far as has been practical, all mechanism has been inclosed.

The oiling system was designed with a view to reducing to a minimum the attention to this vital feature required from the operator. Therefore, it is planned to lubricate most of the parts by splash and spray, or by feeding the oil to them by gravity, or by forced flow. In the housings a mist of oil spray is said to exist at all times when the machine is in operation, and the operator may ascertain its existence by a glance through the glass-covered peepholes. These peepholes have been placed on the housings of all of the late models and clearly show on the spindle housings in Figs. 2 and 3.

Mention has been made of the fact that the gear mechanisms are enclosed in separate unit housings, and bolted into the frame. While many of the frames must



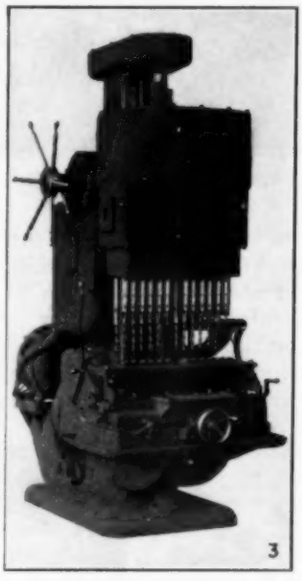
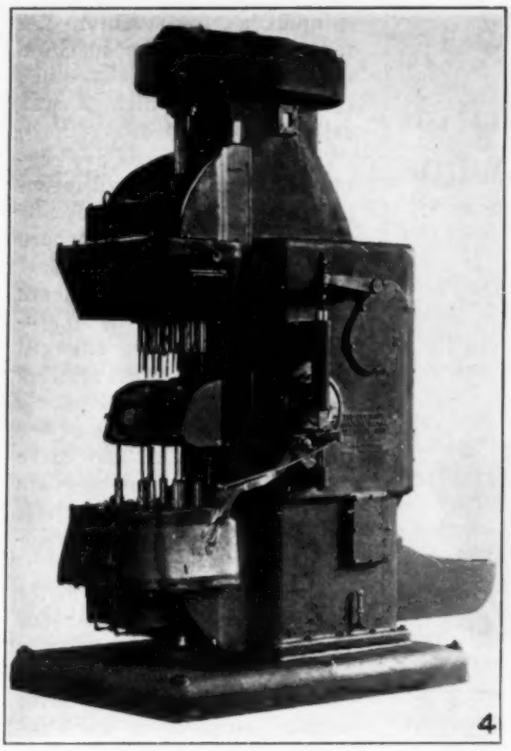


FIG. 2. MACHINE WITH CIRCULAR CAM FEED CONTROL
FIG. 3. LEFT SIDE OF MULTIPLE-SPINDLE DRILLING MACHINE



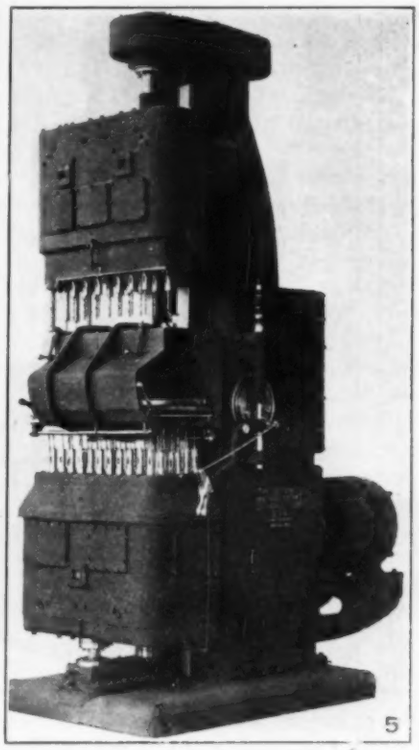


FIG. 4. VERTICAL TWO-WAY DRILLING MACHINE WITH STANDARD WORK FIXTURE.
FIG. 5. TWO-WAY MACHINE WITH TUNNEL-TYPE JIG

be of special design to suit the job for which they are built, it is the designer's intention to use standard units for the different drive mechanisms, such as the feed-gear box, spindle-head-drive gear box, spindle-feed-screw box and the driving box. The units are standard on all the machines of the type, the only variations being those necessarily involved in the creation of different spindle drives for each particular job that has to be handled. The shafting used on all of the drives is made of 0.45-point carbon steel, and either Hyatt or ball-bearings are used on all general drives. Where end-thrust is involved, it is taken care of by means of ball-bearings. The drive gears are steel, carbonized and heat-treated, and all bevel gears in the mechanism are hardened.

The feed mechanism drive unit is housed in the upper compartment on the side of the column, and besides the gearing consists of two friction clutches and a jaw clutch. The friction clutches run in a bath of oil and are provided with ball-thrust bearings to take the end thrust. A system of feed control has been designed to expedite the work, consisting of a cycle of operation that is carried through automatically after the feed control lever is thrown into the starting position, and that stops at the completion of the cycle.

The starting lever engages one of the friction clutches, operating a rapid feed that advances the spindles until the drills are about to engage the work; then the feed lever is shifted and the square-jaw clutch engages the drive during the regular drilling feed. At the conclusion of the cut the other friction clutch is engaged and the spindle housing is returned to its starting position by a quick-return drive. An inter-locking mechanism is employed for the clutch levers, preventing the engagement of more than one clutch at a time.

Two forms of lever-shifting control are employed for the feed mechanisms. One is a straight slide, planed on the side of the spindle-head flange, as shown in Fig. 1, with dogs that engage the control levers and shift them at the proper intervals. Another form employs a circular cam located on the side of the column, Fig. 2. The cam is driven from the feed mechanism and rotates while the spindle-head moves, thus engaging a series of dogs, set on its face, with a plunger that is directly connected with a lever controlling the feed mechanism. This mechanism is started by the small hand lever which trips the feed plunger and permits the cam to start rotating. If necessary, the feed may be stopped at any point by means of the same control lever. It is possible to alter

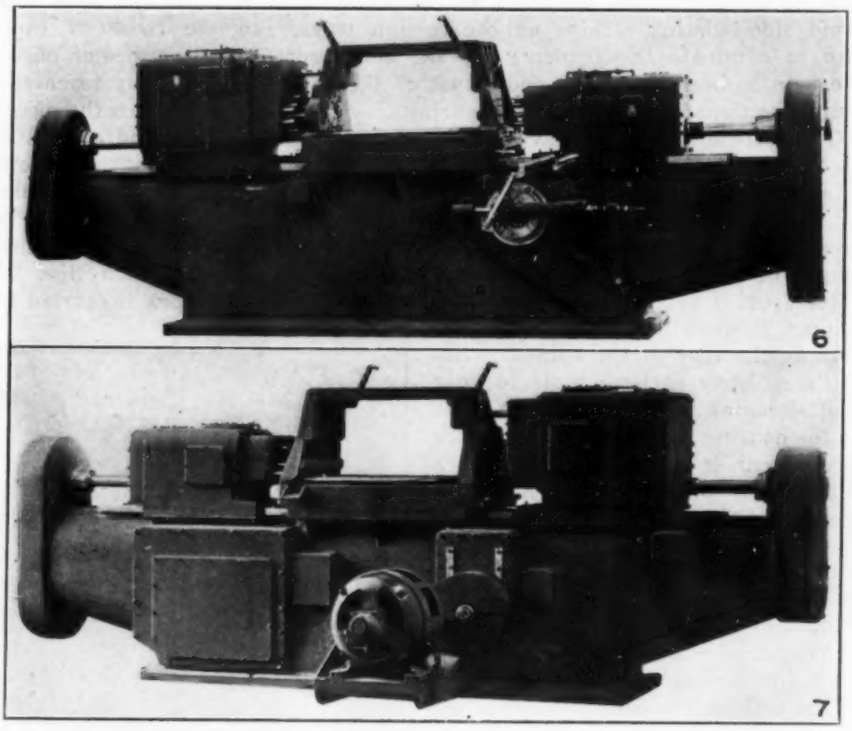
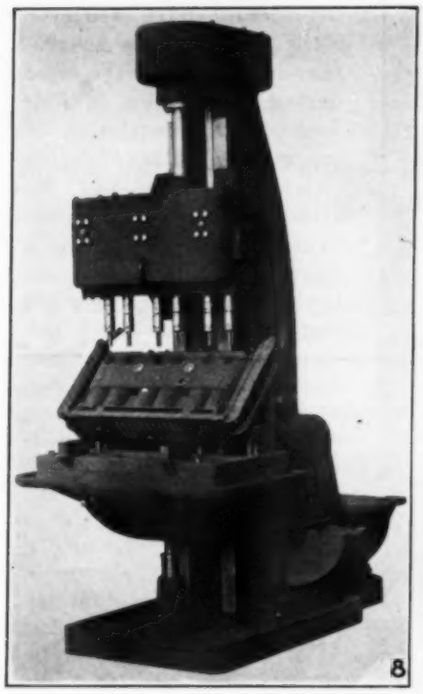


FIG. 6. FRONT OF HORIZONTAL TWO-WAY DRILLING MACHINE. FIG. 7. REAR OF HORIZONTAL MACHINE SHOWING DRIVE MOTOR



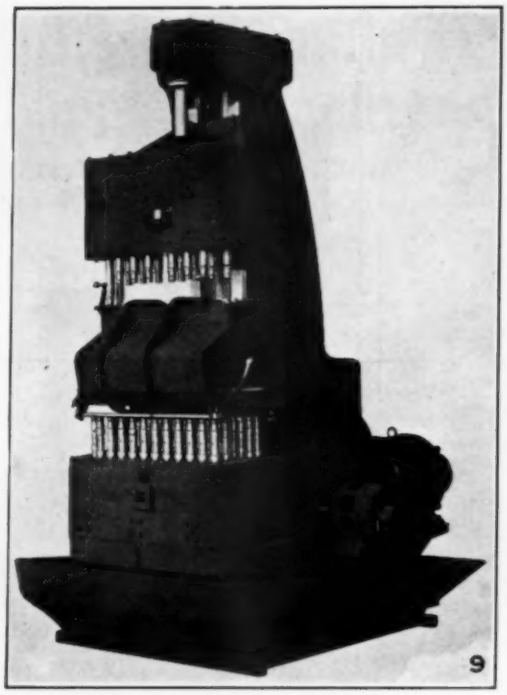


FIG. 8. VERTICAL MULTIPLE-SPINDLE TAPPING MACHINE. FIG. 9. TWO-WAY TAPPING MACHINE WITH TUNNEL FIXTURE AND DOUBLE MOTOR DRIVE

the rate of feed by opening the feed gear-box and changing two gears.

The feed drive is carried by a vertical shaft from the feed-gear box to the feed-screw gear train located in the top of the column housing. The thread of the screw engages a bronze nut located low in the spindle head to prevent the threads from being exposed when the head is fed to its lowest position on the column. It is planned to have the feed screw nearly central with the thrust of the spindles, so that their vertical thrusts will be approximately balanced on all sides and to avoid side-twisting strains on the column ways, and also to eliminate the tendency toward side-thrust in the spindle bearings. The end-thrust of the screw in both directions is borne by ball-bearings.

The spindle head is a heavy housing that completely encloses the drives of the individual drill spindles. It is secured to the ways on the face of the column by square locking gibs, and an apron is usually extended from the body of the housing to secure additional length of bearings. The spindle housing receives its drive from a vertical shaft located in a recess in the column between the ways. An extension on the rear of the spindle housing completely encloses a sleeve gear that slides on the vertical drive-shaft as the housing moves up or down. The sleeve gear is driven by two splines cut directly on the shaft. A spoke-wheel on the left side of the machine, as shown in Fig. 3, is used for moving the spindle housing up or down by hand when setting up work, or for hand-feed.

The late models of the machine employ a removable spindle head on the lower end of the housing. This arrangement, to be seen in Figs. 2 and 3, is planned to permit the attachment of other spindle-heads with spindles at fixed center distances, so that the machine may be used for jobs other than that for which it was originally intended.

The spindle speeds are regulated through a speed mechanism located in the base of the column and placed where it is said to cause the least vibration. The speed gears are driven from the main-drive shaft and are engaged through a Johnson friction clutch with its control handle located on the left side of the machine, Fig. 3. The drive extends from the speed gears to the vertical drive shaft through a set of hardened-steel bevel gears.

Either belt or direct motor drive can be furnished for the machines. The former is arranged to drive with a tight and loose pulley; the latter usually employs a variable-speed motor of capacity corresponding to the power required to pull the drills while cutting.

The two-way drilling machine, shown in Fig. 4, represents in most respects a duplication of the design of spindle head, speed and feed drive arrangements used in the vertical multiple-spindle drilling machines, with the added head placed in an inverted position, so that it will drill the lower face of the work simultaneously with the drilling of the upper face. The special features of the design of the lower head for preventing chips and dirt from entering the spindle bearings are similar to those of inverted-spindle drilling machine heads described on page 633 of the *American Machinist*. This two-way machine is fitted with a work-holding fixture in which the piece is entered from the front. The starting and control mechanism for two heads is operated exactly the same as for a single head.

In Fig. 5 is shown one of the late types of machine fitted with what has been termed a "tunnel-jig", that is used when the machine is a unit in a production transportation line. In these transportation systems the work is carried from one machine to the next on roller

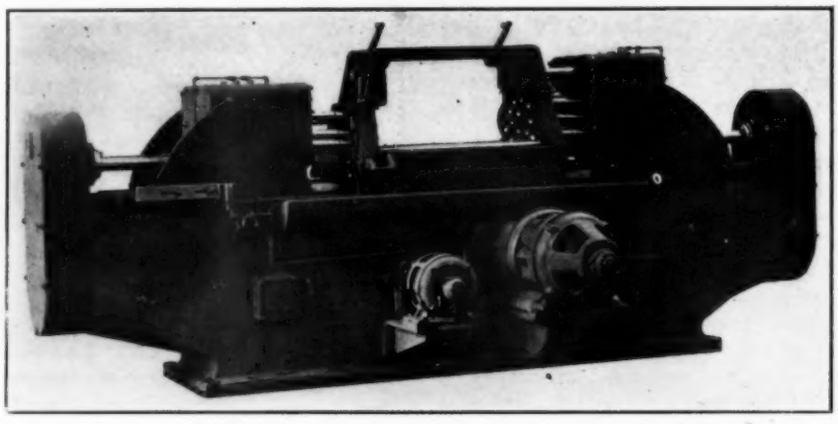


FIG. 10. REAR OF HORIZONTAL DOUBLE-TAPPING MACHINE

tracks, extending to the entrance of the tunnel-jig. In the jig are rollers to facilitate sliding the work into position; and when the work is in place, a mechanism controlled by the lever on the front of the machine permits the rollers to be lowered so that the work will come down to rest on the locating points. The piece is then locked in place and the drilling operation carried through. After releasing the work, it is again raised on the rollers and pushed out of the jig by little effort on the part of the operator.

In order to avoid the manual effort entailed in turning and repositioning work that is carried on production line conveyors, the horizontal two-way drilling machine, shown in Fig. 6, has been developed for drilling the sides and ends of work as it passes along the system. The general details of design are similar to those described in connection with the vertical drilling machines. The examples shown are likewise fitted with tunnel jigs so that the work is virtually carried through the machine. The drive motor is mounted on a pedestal near the floor on the rear of the machine, as is shown in Fig. 7.

The multiple-spindle tapping machines are built along the same general lines used in the design of the drilling machines, and in fact resemble them very closely, as will be noted from the illustration of a six-spindle machine shown in Fig. 8. In all of this line of tapping machines, screw feed has been used to replace the hand-feed method of entering and carrying the taps into the work, as this arrangement is said to reduce the tap breakage. The feed-screw is placed over the center of the head, in order to balance the thrust and keep the wear on the slides even. The feed of the screw must necessarily be arranged to carry the head forward in accordance with the pitch of the taps; likewise, since the taps may not be all of the same pitch, their spindles are so speeded that taps of different pitches will all be fed at an equal rate into the work.

The reversing mechanism of the spindles is governed by a special electrical control. When the taps have entered to the required depth, a dog on the head comes down and hits a stop on the switch, thus shutting off the power and causing the rotor to reverse before it has rotated five revolutions. The quick reversal was designed to be of particular value in tapping dead-end holes. When the motor is reversed, it raises the head to clear the taps from the work, until the control switch is actuated in the opposite direction and the machine then stops. A push-button control with three buttons is provided for governing all operations of the machine. One button is used for starting the motor in a forward direction when the operation on the work is commenced. The second will stop the motor at any time in case of necessity. The third will reverse the motor and bring the machine back to the starting point when it is already in the middle of a cycle, if it should at any time be required to do so.

The two-way tapping machine with fifty-one spindles, shown in Fig. 9, is fitted with a tunnel type of jig similar to the ones used on the drilling machines. It has screw feeds for both the upper and lower heads and its feed control, mounted on the left-hand side of the machine, is governed in the same manner as the machines with a single head. Two motors are provided to drive the different units of its mechanism. A 20-hp. motor serves for the main drive, and the smaller motor mounted on a bracket on the right side of the machine drives the coolant and lubricating oil pumps, so that they are not affected by the reversal of the main drive motor at the completion of the tapping operation.

A rear view of a horizontal tapping machine is shown in Fig. 10. This machine likewise is fitted with two motors, one for the main drive and the other for operating the coolant and lubricating oil pumps. Horizontal tapping machines can be fitted with tunnel-jigs or any other of the types of work-holding fixtures that best adapt them for fitting into production lines.

Loose Bushing for Loose Pulley

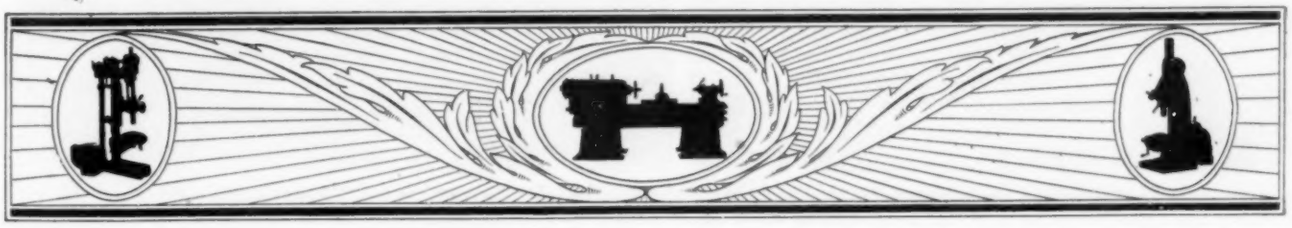
By W. T. Elzinga

Many of us have had and are having trouble with the loose pulley. We neglect to oil it because it needs so much attention. It usually means that we must find a ladder and do some climbing and risk our fingers. This is all wasted effort it seems.

The other day, while visiting a garage, I saw a dry grinder with a tight and loose pulley on the spindle, driven direct from the lineshaft. It was rattling merrily at the rate of some 1,500 r.p.m. and without attention, except perhaps once a week or even less. The pulley was worn at least $\frac{1}{32}$ in. large and would soon need a bushing. The dealer selling this grinder said that the price being low no provision for a good oiling system could be made.

Having received permission to make an improvement we took the spindle to our school shop, bored the pulley about $\frac{1}{16}$ in. larger and turned a cast-iron bushing to a sliding fit for both pulley and spindle. We next drilled about a dozen $\frac{1}{4}$-in. holes in it, so spaced that they were not in line with the oil hole in the hub, filed several helical oil grooves *between* the holes, filled the holes with plugs of felt (we keep an assortment of old hats for such purposes), tapped the oil hole in the hub for an oilcup, assembled the spindle and put it to work again. It has been running now for several weeks and the owner is happy because its noise does not distract him any more and he can forget about oiling it.

We have in our school shop a dozen or so pulleys with bushings from $1\frac{1}{4}$ to 3 in. in diameter so treated and they are certainly a great improvement over the old style. We have eliminated several counters on account of this kink. It seems that this bushing slips around in the hub and turns about half the speed of the pulley, distributing the wear over pulley, bushing and spindle. The larger area and the oil being held by the felt, this method has proved to be much better than bushing the pulley in the old way.



Holding Fixtures for Railroad-Shop Work

Clamping Fixtures for Boring Mills—Ganging Work on the Planer—Boring Driving Boxes—An Expanding Mandrel for Lathe Work

WESTERN CORRESPONDENCE

DESPITE biased opinions to the contrary, the majority of railroad shops are constantly introducing more efficient methods to secure greater production. A recent visit to the locomotive shops of the Chicago & Alton R.R. at Bloomington, Ill., showed many endeavors on the part of the executives to cut idle machine time to a minimum.

Inadequate and slowly-operated work-holding fixtures are the cause of one of the most common losses of machining time. Under-loading of machines, and particularly planer tables, constitutes another source of loss, but this is frequently caused by poorly designed fixtures, as has just been mentioned. The management of the shops under consideration is endeavoring to remedy both of these faults and a few examples of what has been accomplished are illustrated.

Driving wheel tires are clamped to the table of the boring mill by four special clamps similar to the one shown in Fig. 1. The body of the clamp *A* has a tongue that fits in the table slot and is held down by a heavy T-bolt. The tire is centered and held by the screw *B*, while the screw *E* on the top of the jaw holds the tire down. The forged jaw *C* swings on a bolt *D* passing through the body and is shown in the position used for clamping down the tire while taking a heavy boring cut. For taking a facing cut across the tire the top screw is loosened and the jaw swung out of the way into a horizontal position.

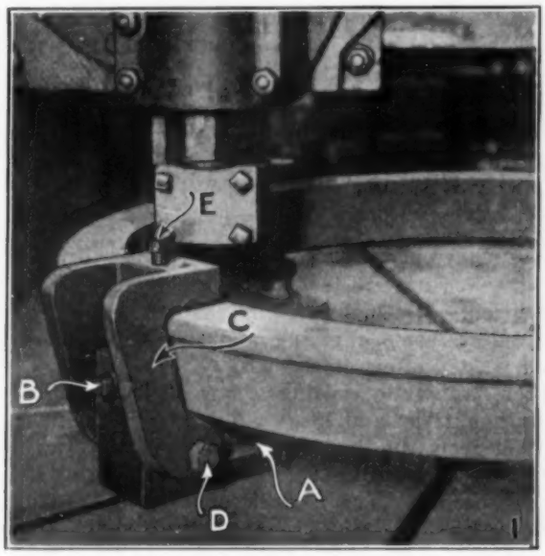


FIG. 1. CLAMP FOR HOLDING TIRES ON THE BORING MILL

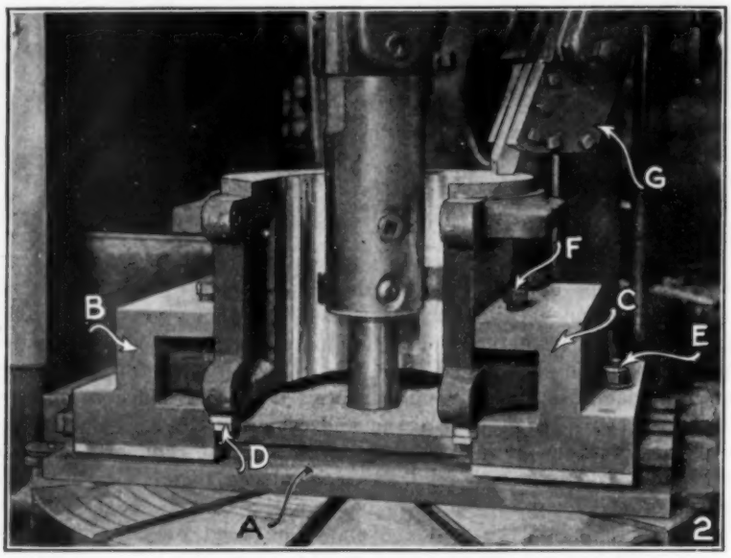


FIG. 2. SPECIAL CLAMPING FIXTURE FOR DRIVER BOXES

Boring Driving Wheel Boxes

The boring mill shown in Fig. 2 has been rigged up with a special work-holding fixture so that two cuts can be made simultaneously on driving wheel boxes. These cuts bore the box and face off the hub flange.

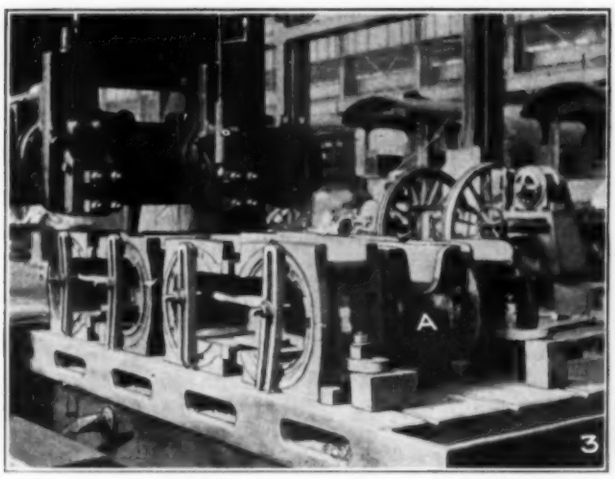


FIG. 3. FULL SET OF DRIVER BOXES MOUNTED ON A PLANER TABLE.

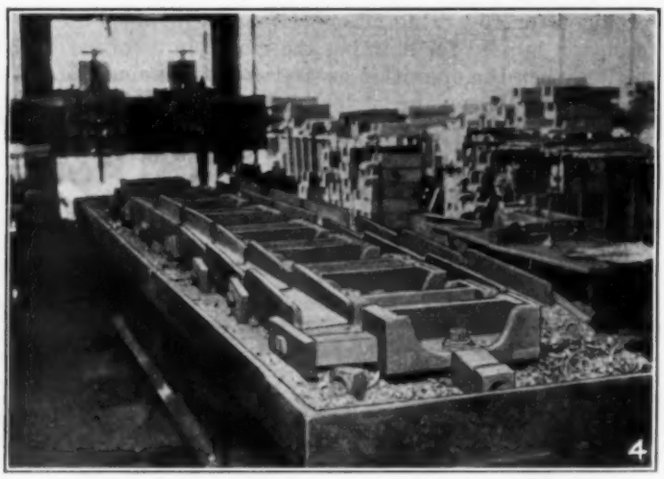


FIG. 4. PLANER SET-UP FOR FINISHING OF SHOES AND WEDGES

The work-holding chuck has a base *A* bolted to the table of the machine. Its top face and sides are planed to provide ways for the two jaws *B* and *C*. The jaw *B* is set up with a stop at its back and can be positioned to suit any size of driving boxes so that each box will be centered when put in place. The planed side of the box comes up against the squared edge of the jaw, and the back against a dog located on the strip *D*, thus insuring that each one of a set of boxes will be in the same position.

The work is removed by loosening the nut *E* and pulling out the jaw *C*. After putting in a new piece of work the jaw *C* is slid back in place so that the edges of both jaws come against the planed sides of the box, and the nut *E* is tightened. Four screws *F*, two in each jaw, are then tightened down on the flanges of the box to hold it firmly in place. The boring bar has been fitted with a pilot that passes through a bushing in the base of the fixture. A special toolholder *G* for working at an angle has been provided for the hub-flange facing tool.

A full set of driving wheel boxes is set up at one time as shown in Fig. 3, for the planing operations. A heavy cast-iron center frame *A* is bolted down in the center of the table as shown. This frame has been carefully planed on both sides, and T-slots have been machined, one on each side, to serve for rapidly and easily bolting on the work in the manner shown. For additional firmness the boxes are also clamped to the planer table.

A job of planing shoes and wedges is shown in Fig. 4. Again in this case a set of parallel spacing blocks

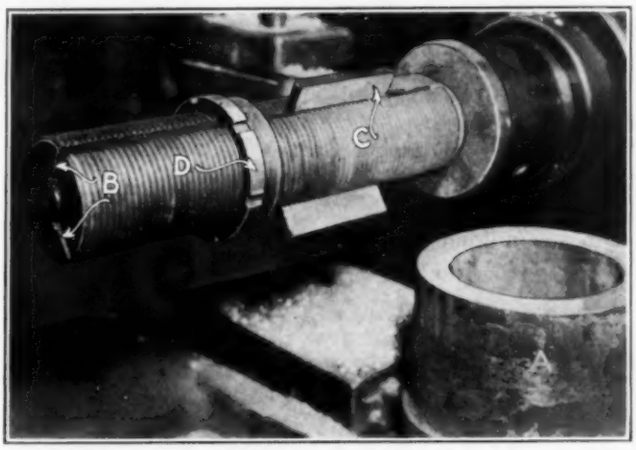


FIG. 5. AN EXPANDING MANDREL FOR TURNING BUSHING

serves to facilitate the set-up of the work. Moreover, the spacing blocks are of sufficient width so that both toolheads can be used to finish the two lines of work. In this case the bolts for clamping the work pass clear across the table so that each bolt serves to hold two pieces.

The expanding mandrel shown in Fig. 5 for turning bushings similar to the one shown at *A* was made in the shop's toolroom. Several sizes of these mandrels have been made; the one shown having an outside diameter, over the threads, of 3 in. and a length of about 14 in. There are three T-slots *B* cut on a taper of $\frac{3}{8}$ in. to the foot in which slide three blades *C* that fit in the T-slots. The inside edges of the blades are tapered to match the taper of slots and their outside edges are parallel with the center line of the mandrel. They are about 4 in. in length.

In mounting work the blades are slit down the taper of the arbor until they are contracted sufficiently to enable the bushing to be slipped over them and are then forced up the arbor by turning the nut *D* until they have been expanded sufficiently to grip the bushing firmly. Wider or narrower blades may be used on the same mandrel, allowing it to handle a greater range of bushings than would otherwise be possible by the total expansion permitted by the taper in the slots. Thus each successive set of blades should be increased in size an amount equal to the increase of the taper for the length of slot traveled in expanding from minimum to maximum. In this case the total travel is 6 in., the gain is $\frac{1}{16}$ in. and so each set of blades should be $\frac{1}{16}$ in. larger than the preceding. The mandrel is carried and driven by a coupling attached to the lathe spindle, and the outboard end is supported by the tail center. It is stiff enough so the heaviest practical cuts may be taken.

Ten Safety Rules for the Factory

BY GEORGE SWETNAM

1. Open high voltage switches and transformers should be enclosed, or at least fenced off from the rest of the factory. Prominent signs should also be posted.

2. Concealed wiring is less liable to receive damage which will cause fire or accident than is open wiring. Use it. It is also well to protect all bus bars from possible falling wires, etc.

3. Forbid workmen to crawl through narrow, moving belts. This seems foolish but if you will watch you will be surprised at the prevalence of this little short of lunatic performance.

4. Never run a boiler at a pressure higher than its rating without the advice of the maker. The same is true of superheaters and engines.

5. Most boilers are kept too full, as this does much to prevent explosions. It causes priming, or water in the steam, which is likely to cause broken piston-rods, cylinders, and cylinder heads, and scored pistons and cylinders, to say nothing of making packing renewals very frequent. Avoid this trouble by having the chief engineer look the boilers over frequently.

6. It happens once in a while that a lazy fireman keeps his boiler only about one-half full, being under the false impression that so doing makes firing easier. As this is only courting explosions it is best to dismiss such a man at once.

7. Never allow machines to be cleaned while running. Any number of one-armed men could testify to the foolishness of such an act. It is still sometimes done.

8. Don't let bearings stay loose. They endanger life and property by causing broken shafting, and are responsible for loss of power.

It seems useless to say this as it should be an axiom, but I know of one man who ran his plant with an important bearing loose for more than a month, cutting down his production perhaps as much as 25 per cent.

9. Bar all irresponsible persons and children from your plant while it is running, unless they are accompanied by a careful escort.

10. Don't wait until an accident occurs to put these rules into operation. You are responsible for the safety of all concerned. Act!

Proposed Standard Roller-Chain Sprocket

Excerpt from Report of Chain Division of Standards Committee, of Society of Automotive Engineers at West Baden, Ind., May 24, 1921

THE first tooth forms for roller-chain sprockets were designed upon the theory that the tooth action was similar to that of gear teeth, the chain being regarded as analogous to a rack. It was, however, soon found that when chains had been in use a short

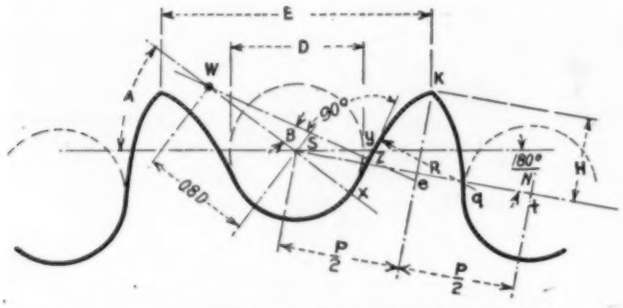


FIG. 1. ROLLER-CHAIN SPROCKET TOOTH FORM

time the wear at the joints caused an elongation of the pitch of the chain, thus destroying the perfect registration with the sprocket teeth which resulted in rough action and rapid wear. The sprocket teeth were then redesigned to provide for the chain elongation by making the tooth gap somewhat greater than the diameter of the chain roller, but with little or no modification in the contour of the tooth, which was so shaped that the chain roller bore almost squarely against the sprocket tooth, throwing practically the whole load on a single tooth.

Meanwhile, the use of roller chains became more extensive and the demands made on them more exacting. This condition naturally led, both in this country and abroad, to a more careful study of the action between chains and sprocket teeth than had heretofore been given to the subject, and it soon became apparent that by giving some obliquity to the face of the sprocket tooth, quite different and decidedly better results could be obtained. The action of the forces called into play can be readily analyzed by the graphic method of laying out a parallelogram of forces which will show in true proportion the initial tension on the chain, the resultant thrust on the sprocket tooth (determined by the degree of obliquity selected) and a balancing force passed on to the ensuing links of the chain where this action is repeated in a lessening amount.

By this method the load on a chain may be distributed over several teeth of the sprocket and at the same time, by extending the oblique portion of the sprocket tooth a suitable distance, make it possible for a chain of elongated pitch to slide outward on this oblique face until it finds a pitch circle on the sprocket coinciding with the lengthened pitch of the chain. These general findings were freely exchanged among the chain manufacturers and one of the English companies published a brochure on the subject. During the war more pressing matters prevented an interchange of opinion on this subject, but nevertheless most of the sprocket manufacturers evolved tooth forms along these lines.

It is now proposed to effect an agreement upon one standard form that shall supersede the various individual designs and the formula now presented by the Chain Division for adoption as an extension of the present S. A. E. Standard for Roller Chains, page E3, S. A. E. Handbook, Vol. I, is a composite of the best features of the various tooth shapes that have been tried and pronounced satisfactory.

P — Pitch of chain
D — Nominal roller diameter
N — Number of teeth in sprocket
D' — Diameter of seating curve $= 1.005\ D \div 0.003$ in.

$$A = 31^\circ + \frac{90^\circ}{N}$$

$ws = 0.8\ D$

$$B = 13^\circ - \frac{18^\circ}{N}$$

xz — A circular arc whose center is at w
zy — A straight line perpendicular to wz

$$xy = 1.3\ D \times \sin\left(25^\circ - \frac{90^\circ}{N}\right)$$

ek — A line perpendicular to st
H — Height of tooth crest above the chord $st = 0.35\ P$
qy — A line parallel to wz with q so located that the circular arc through y will pass through k, thus forming a pointed tooth.

Outside Diameter of Sprocket = Pitch Diameter + $P\left(0.7 - \tan\frac{90^\circ}{N}\right) = \text{(approx.)}\ P.D. + P\left(0.7 - \frac{1\,592}{N}\right)$

$$E = O.D. \times \sin\frac{180^\circ}{N}$$

Cutters shall be designed for 6, 7-8, 9-11, 12-17, 18-34, 35 teeth and over.

The number of teeth on which each cutter shall be based is, $M = \frac{2\,N\,n}{N+n}$, where "N" and "n" are the maximum and minimum number of teeth to be cut by any given cutter. A sprocket having N teeth will thus have

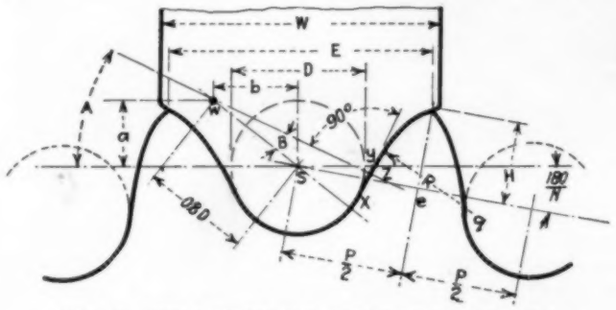


FIG. 2. ROLLER-CHAIN SPROCKET CUTTERS

a pressure angle which departs the same amount from the desired pressure angle as one having n teeth.

The values of M for the various cutters are respectively, 6, 7.47, 9.9, 14.1, 23.54 and 65.42 teeth.

Cutter numbers shall be respectively, 6, 7½, 10, 14, 24 and 65.

$D' = 1.005\ D + 0.003$ in.

$$A = 31^\circ + \frac{90^\circ}{N}$$

$ws = 0.8\ D$

$B = 13° - \frac{18°}{N}$

xz = A circular arc with w as the center

zy = A straight line perpendicular to wz

$xy = 1.3\ D \sin\left(25° - \frac{90°}{N}\right)$

$se = \frac{1}{2}\ P$

$ek = H = 0.35\ P$

yq = A line parallel to wz

q = is so located that the arc yk, struck from q as a center will pass through k

The radius R may be determined graphically.

Where the same roller diameter is used on chains of two different pitches, (as $\frac{5}{8}$-in. roller, 1-in. pitch; and $\frac{3}{4}$-in. roller, $1\frac{1}{4}$-in. pitch), cutters No. 6 and $7\frac{1}{2}$ shall be designed for the longer pitch, and may be used for cutting sprockets of the shorter pitch. Cutters No. 10, 14, 24 and 65 shall be designed for the shorter pitch and may be used to cut sprockets of the longer pitch.

W = with of cutter $= 1.02 \times O.D. \times \sin \frac{180°}{N}$, to the next higher 32nd inch; where $O.D.$ equals the outside diameter of the sprocket with the larger pitch and the lowest number of teeth to be cut with the cutter.

The specifications to the cutter maker may be simplified if w and z are located as follows:

$a = 0.8 \times D \times \sin\left(31° + \frac{90°}{M}\right)$

$b = 0.8 \times D \times \cos\left(31° + \frac{90°}{M}\right)$

$z = 2.6 \times D \times \sin\left(61\frac{1}{2}° - \frac{90°}{M}\right)$

Johnson Organizes a Shop Progress Committee

BY JOHN R. GODFREY

I've been wondering how Johnson was standing the gaff these days, so I dropped in to see if his pet schemes had worked out. I landed just in the midst of a confab with his foreman, but he asked me to "sit in and favor them with my experience." Johnson is some kidder, at times. I didn't have to do much talking—'twas almost a monologue with Johnson as the star performer.

"Boys, we're up against it—and we've got to find a way out. Times are bad—they had to be after the past six years. You can't rip the world up the back without paying the penalty. We spent money like drunken sailors. We said, 't'ell with the cost,' whether it was silk shirts or automobiles. And now the piper has to be paid. It would be bad enough if all had profiteered alike. But we've got to face the music and get down to business.

"We've got to remember that business just has to come back. The country will go on. Motors will be used and the best will have a good business when things simmer down. Everyone is suspicious. They've been robbed and they know it. Now they're fighting shy of everything. But it can't last forever. In the meantime we've got to live—and we're going to live—don't forget that.

"But we've got to go on rations just as a shipwrecked crew does. We don't want to chuck anyone overboard to the sharks, but if anyone falls off, we can't endanger the rest attempting a rescue. In other words, if anyone drops out, we won't replace him. But if we find a chap who won't take his full turn at the oars, or refuses to bail when his turn comes, overboard he goes.

"We've been paying too much for cast iron and that's the basis of all modern business. But the iron producers seem to be slowly coming down to earth and that will help a lot. But until orders come faster we'll make up parts of motors that use least material and take the most labor. In other words, we'll 'store labor' to keep our organization life-boat together as long as we possibly can.

"We'll make up sub-assemblies and tuck them away on the shelf as long as we can stand the pressure. And the new machinery we've put in will reduce the cost on these, so we won't tie up so much capital in stock. We're not going to shut down if there's any way to prevent it, but we may have to go on short time when the cash balance runs too low.

THE TIME FOR CO-OPERATION

"The main thing I want to get over to the men is that everyone who does his level best, is one of the family—he belongs to the elect and no one is going to be dumped without cause. We want every man to realize that he is part of the organization and not a mere attachment to any machine. We want the closest kind of co-operation and we want any ideas or suggestions they may have floating around loose, and they probably have more than you dream of.

"This is the time when most of the other shops in town are forgetting all their fine talk about 'personnel' work and the value of harmony. Seem to think because good jobs are scarce they can go back to the old 'master and man game' and get away with it. But they're guessing wrong again. They'll lose out when things get back to normal.

"Now is the time to plant the best seeds of co-operation you can find, and to cultivate them with care. And the best way to cultivate them is to prevent misunderstanding. I've thought this over a lot, boys, and I believe we better have a clearing house for ideas, troubles and other things. Suppose we call it the Shop Progress Committee—or any similar name. Anything but a grievance committee, and that's one thing we want to keep away from—don't want to even suggest grievances.

"I'd suggest that each department elect a representative to this committee and that all suggestions, questions, requests, etc., come through that representative to the foreman of the department. If it needs to go further, it can come up to the whole committee, which can have regular or special meetings as required.

"We want a place where everything can be done in the open, where every request or suggestion can be threshed out. If changes in piece rates are necessary, we can show our side and get the other as well. If bonuses or wages come up for discussion, it's just the same. I have a hunch that one of the great disturbers of shop peace and harmony is arbitrary actions on either side. No man likes to feel that he can be fired unjustly by a foreman with a grouch due to cold pancakes or other snags in the domestic relations. Neither does he fancy a cut in rates without a discussion as to the whys and wherefores. So I'm going to try and play the game that way and I want you to help me.

"You might talk it over with your men. If they help do the organizing, the committee will work better than if we hand them a cut and dried plan. They want to 'belong'—to be a part of the institution—and they are bound to take more interest if they do. After this Shop Progress Committee gets going in good shape we'll ask Godfrey here to come down and give it the double O."

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Three Pattern Making Kinks

SPECIAL CORRESPONDENCE

Three pattern-making kinks, all connected with gearing, are illustrated herewith. They are from the pattern shop of the Vulcan Iron Works, Denver, Col., and

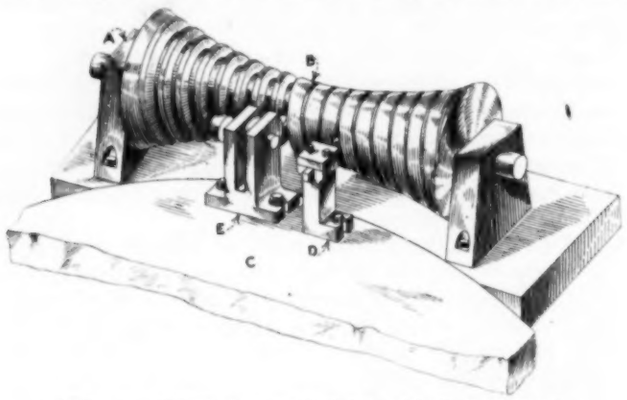


FIG. 1. MAKING A HINDLEY WORM PATTERN

stand to the credit of R. Bristow, a veteran pattern maker who rarely passes up any problem which may be presented, regardless of its difficulties.

Some months ago the shop job called for a fair-sized Hindley worm, and it was finally decided that the only way in which this could be procured in this particular case was to have a pattern made from which a casting could be secured. The making of the pattern was put up to Mr. Bristow, and after some deliberation it was made in the following interesting manner. The spool

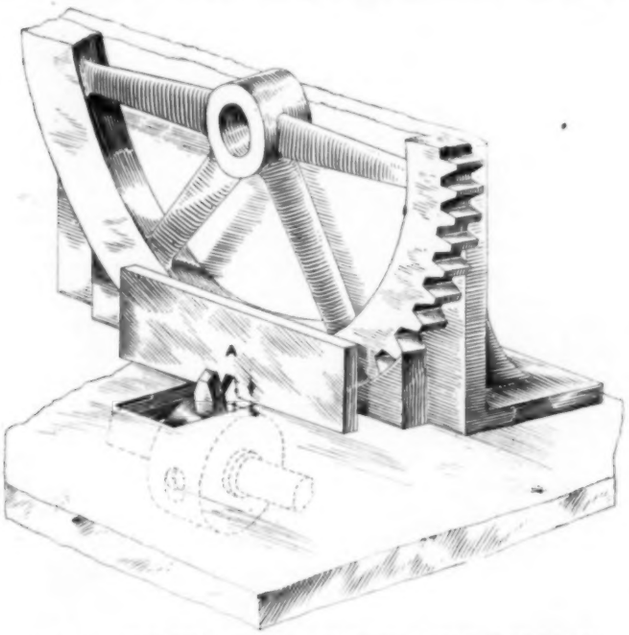


FIG. 2. CUTTING TEETH IN SPUR GEAR PATTERN

or body of the worm was first mounted on a steel bar and turned up to the correct size and shape. The path of the worm thread was then carefully laid out with a pencil, and a shallow groove cut along the pencil line with a file, to act as a guide in future operations.

The blank for the worm pattern was then mounted on a base *B*, Fig. 1, with end blocks, one of which is shown

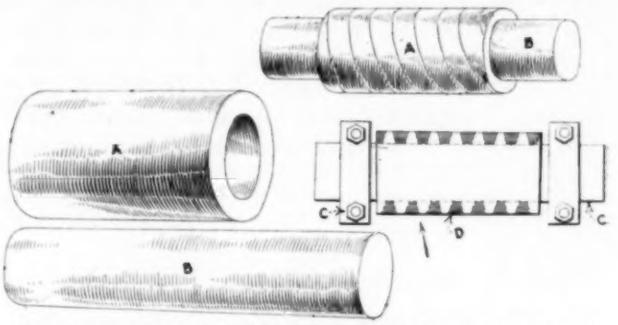


FIG. 3. MAKING A WORM PATTERN ON A BANDSAW

at *A*. The back edge of the base was cut to the same radius as the pitch line of the worm. This curved edge fitted against the guide *C*, which enabled the block carrying the worm to be moved on the correct radius.

The block *D* carried a wooden guide, which fitted into the shallow grooves that marked the path of the worm thread, while *E* is a cutter head fitted with a fly cutter to give the correct shaped tooth to the worm thread. This, of course, was located radially with the arc of the guide *C*.

Placing the base carrying the worm to be cut so that one end of the thread was central with the fly cutter, and having the guide *D* properly located in the thread groove so as to control the lead, Mr. Bristow turned the worm by hand against the revolving fly cutter. As the roll was turned the carriage, or block in which it was mounted, was advanced along the curved guide *C* as guided by the block *D* bearing in the thread groove. By careful feeding Mr. Bristow was able to cut the worm thread along the line and groove first laid out, until over half the worm was cut. Then by reversing the worm in the block and using the thread already cut, he was able to complete the cutting without difficulty. This made a comparatively simple solution for a somewhat difficult job.

In another gear pattern job Mr. Bristow used a fly cutter to advantage in cutting the teeth of a large spur gear, as shown in Fig. 2. The gear pattern was joined and turned up; then it was placed in the frame *A*, square with the fly cutter and clamped against the angle plate as shown. Most of the stock was first moved by circular saws, after which the teeth were completely finished by the fly cutter. A simple method of indexing was devised and the use of the fly cutter greatly reduced the time necessary to make the piece in the usual way.

In another case it became necessary to make a fair

size worm pattern and Mr. Bristow adopted an interesting and novel method of cutting out the thread. He first turned a cylinder as at *A*, Fig. 3, the inside diameter representing the root or bottom of the thread, the depth of thread being the thickness of the cylinder and the length corresponding to the desired worm. He then turned up a center core, which was a snug fit inside the cylinder as at *B*.

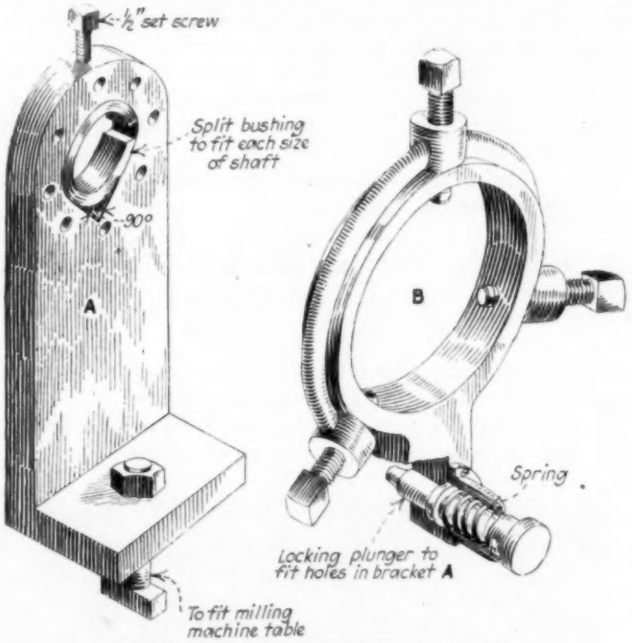
The next step was to lay out the thread on the outside of the cylinder and to mount the cylinder and its supporting core on suitable blocks as at *C*. These blocks must hold the worm at the proper angle, both for the sides of the thread and also for the lead. When so rigged up, it was an easy matter to cut the thread on a band-saw. By sawing through the cylinder, carefully turning it and at the same time moving it along the band-saw table to take care of the lead, the complete thread was formed by a single cut on each side, the shaded portion *D*, between the thread being removed.

A Simple and Inexpensive Indexing Rig

By Richard H. Kiddle

For the man who has no centers for his milling machine the device illustrated and described here may be of interest.

Two brackets as shown at *A* are made of cast iron to bolt on the machine table, and a dog as at *B* carries a



AN IMPROVISED INDEXING DEVICE

spring locking pin that engages in the circle of holes surrounding the opening in one of the brackets.

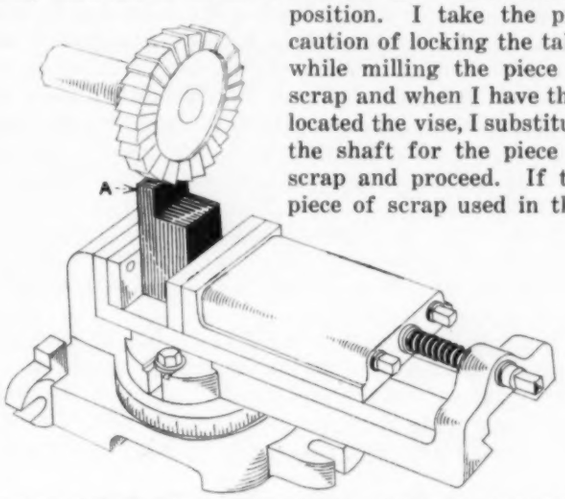
To use the device for splining shafts of a diameter other than that for which it is originally made, split bushings can be fitted to the openings in the brackets.

Center Finding Tool

By Atol Maker

On Page 288 of the *American Machinist*, Mr. Moore has described a special attachment which he uses when setting a piece of round stock in relation to a milling cutter, which calls to my mind a method that I pursue when I find it essential to machine a slot or keyway precisely in a certain position.

I place a piece of scrap steel in the milling machine vise and mill away the stock as shown in the sketch with the slotting cutter. By measuring at *A* I can readily determine when the cutter is in the desired position. I take the precaution of locking the table while milling the piece of scrap and when I have thus located the vise, I substitute the shaft for the piece of scrap and proceed. If the piece of scrap used in this



SETTING A SLOTTING CUTTER TO A DEFINITE POSITION

case is not of the same diameter as the shaft it is very essential that point *A* of the piece rest against the stationary jaw of the vise.

It may be well to mention that I only pursue this method when precision is desired, and before I attempt to locate the cutter or vise I determine just how wide a slot the cutter produces.

A Spring-Winding Device

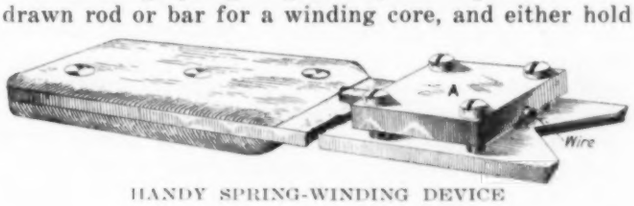
By John T. Slocomb

I have always noticed that the average machinist dislikes to wind springs. By our usual methods this work seems to involve considerable fuss to accomplish little.

A few days ago I saw in use the little device here illustrated and tried it; and I must say that for a spring winder it is quite a discovery. I understand that it is old but feel sure that few have seen it.

Made as illustrated it consists of a bar of soft steel 18 x 1½ x ¼ in, with one end notched and beveled inside as shown, and with the wooden handle riveted on the other end. The clamp *A* is made of brass and, with its four ¼-in. screws, is used for a combination wire guide and friction binder or tension on the wire while the latter is being wound. The V groove in the under side of the binder should be well rounded on the back end to prevent tearing or shaving the wire.

In winding springs I generally use a piece of cold-drawn rod or bar for a winding core, and either hold



HANDY SPRING-WINDING DEVICE

it in a chuck or between lathe centers. To hold the end in starting I sometimes drill a hole through the bar and insert the end of the wire, or else clamp it to the rod with a lathe dog; and then again sometimes it comes handy to stick the end between the jaws of a lathe chuck. When a hole through the rod is used to hold the end of wire it becomes necessary to cut

the wire with a hack saw or chisel in order to get it off. This device is made long, with a strong handle, so it can be controlled when held at different angles.

In winding a close spring, the winder is held with the flat and clamp side toward the work but in winding an open spring it is held with the clamp side away from the work, and the particular angle at which it is held sets the pitch. The V in the end makes a supporting rest, so that very long springs can be wound on a slender rod. I wound some springs of $\frac{1}{32}$-in. steel wire on a $\frac{3}{4}$-in. arbor with one of these winders, and did it very easily.

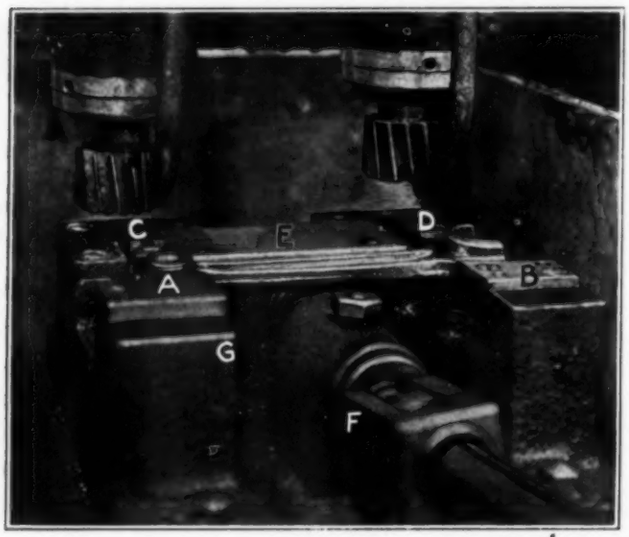
Because of the strong tension, these springs will open up very little after winding. In winding an open spring the device is turned over to close the end in, making a square end.

When it is desired to wind a number of springs at once the device is turned over where the end of each spring comes and the end closed in, which also starts the next spring with a square end. Then after a lot are wound they are cut apart in the proper places.

A Connecting Rod Fixture

By I. B. Rich

The illustration shows a fixture for holding connecting rods while being milled on both surfaces. The rod is located by the fixed jaws *A* and *B* which have suitable



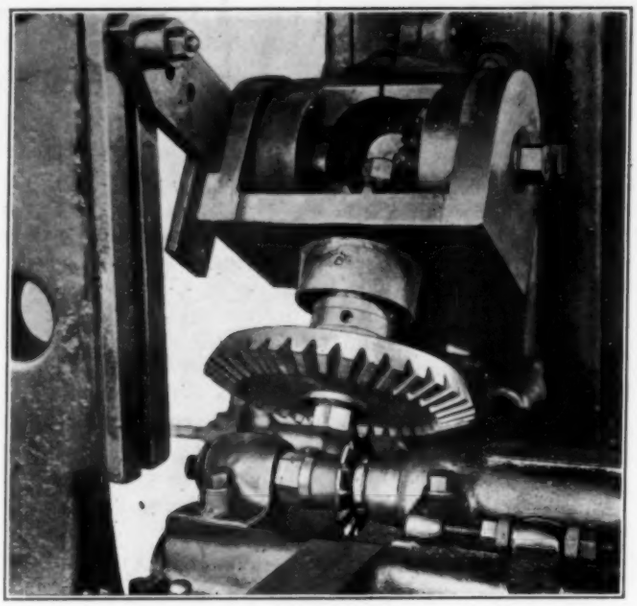
A QUICK-ACTING CONNECTING-ROD FIXTURE

V's for locating them by means of the bolt bosses. The rods are clamped against the fixed jaws by the sliding jaws *C* and *D* which are connected by the central plate *E*. The jaws are brought against the work by means of a cam at *F*, this being connected to the plate *E* by a central bolt attached to the lower part of the plate. The spring *G* opens the jaws as soon as the cam is released. This fixture is quick acting, of simple design and holds the work firmly at both ends.

Attachment for Rough-Cutting Bevel Gears on a G & E Automatic Spur Gear Cutting Machine

By August De Angelis

In the manufacture of our machines there are many bevel gears required and we had but two Gleason bevel-gear generating machines, one of which was



ATTACHMENT FOR ROUGHING BEVEL GEARS ON AUTOMATIC SPUR-GEAR CUTTER

used for rough cutting and the other for finishing. The production from these machines did not meet our needs, so we conceived the idea of using an old Gould & Eberhardt spur gear-cutting machine to help out.

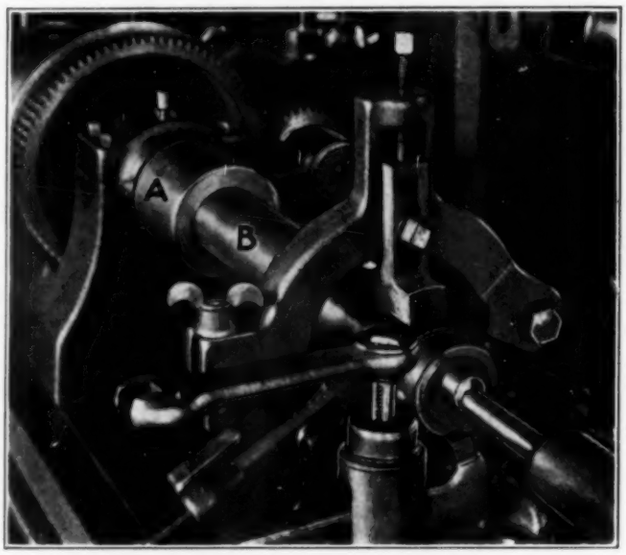
We designed the attachment shown in the accompanying photograph to do the rough cutting so that we could keep the two generating machines busy on the finishing, and found it to work out very satisfactorily.

One side of the attachment is graduated so that it can be set at any angle.

A Device for Turning Eccentric Journals on Back Gear Shafts

By Milton Wright

The back gear shaft of a lathe as usually constructed requires that eccentric journals be turned on the ends, the amount of eccentricity being greater or less according to the size of the lathe.



DEVICE FOR TURNING OFFSET JOURNALS ON BACK GEAR SHAFTS

To do this work in the way that it is ordinarily done means to lay out and drill a pair of centers in each shaft sufficiently removed from the original centers to give the required amount of offset and in exactly the same plane. This method demands the services of a skilful and experienced man, and even then the chances for error are large, especially if the shafts are being run through in quantities.

The device here illustrated and described eliminates the possibility of error once the setting has been established and does away with the necessity for the extra centers, though making it perfectly easy to drill them if they are desired.

A chuck *A* is made to screw on the nose of the lathe spindle, the hole in the face of the chuck being ground to take the shouldered ends of the long sleeve *B*. There is a keyway in each end of the sleeve and a nicely fitting key in the chuck so that the sleeve when entered at either end can occupy but one position circumferentially.

An eccentric bushing is fitted to each end of the sleeve, the amount of eccentricity being equal to that required on the shaft.

A heavy setscrew is inserted radially at each end of the sleeve to bind the shaft. The setscrew passes through the eccentric bushing and bears upon a hardened steel key that is fitted to a slot in the bushing and ground in place so that the surface presented to the work is a part of a true circle of the same diameter as the work and does not mar it.

The outer surface of the sleeve, of course, runs true; one end being held in the chuck and the other in the jaws of the center-rest. It is but the work of a moment to throw back the upper part of the rest, withdraw the sleeve from the chuck and reverse it; the shaft in the meantime not being disturbed.

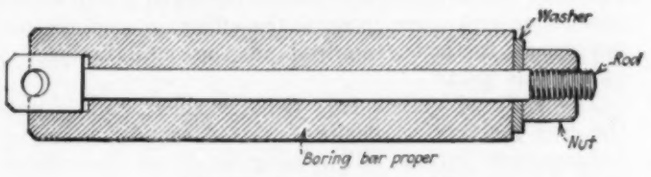
With this device a lot of such shafts may be roughed out and the offset centers drilled without the possibility of error for there is no laying out to be done.

A Boring Bar of Merit

By B. Gilbert
Barrow-in-Furness, England

What, precisely, is the merit of the tool illustrated by Mr. Houssman under the title "A Boring Bar of Merit," on page 278, Vol. 53, of *American Machinist*?

E. Lytton Brooks, on page 113 of the current volume, objects to having the turner use a machine spanner to knock the wedge in and out, but it is exactly this



A SUPERIOR BORING BAR

knocking of the wedge that puts the bar out of merit, in my judgment.

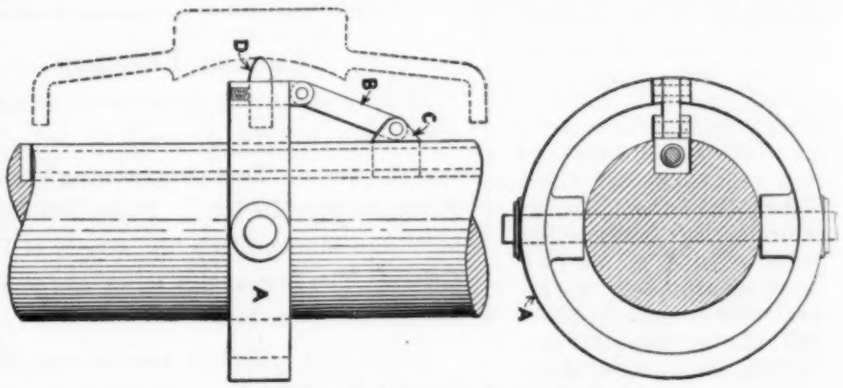
Human eyes are too precious. Soft wedges are useless. Fellows are careless enough without adding further to their risks. I submit herewith the sketch of a bar that has been in use for several years, that is in many ways superior to the one shown by Mr. Houssman.

Boring Bar for Spherical Holes

John S. Watts

The accompanying illustration shows a boring bar that the writer designed for boring out the pedestal for a ball and socket type of bearing. As this is a job that is likely to crop up occasionally in the repair shop, and as tools for doing this work are not usually available in such a shop, a description of the bar may be useful to others.

The main part of the tool is the regular boring bar with a screw feed such as is commonly used for re-boring cylinders, etc., and is a regular part of the equipment of a machine shop handling repair work. On this bar is pinned the ring *A*, which may be forged or cast steel. The pin should be a good fit



BORING BAR FOR SPHERICAL HOLES

in both the bar and the ring, being just free enough to allow the ring to swivel without excessive friction.

A hole is drilled in the ring to take the cutting tool *D*, which is clamped by a setscrew. On one side of the ring will be seen a double eye, which can be cast on if the ring is cast, or screwed on if the ring is a forging. The double eye is fitted with a link *B*, which connects it to the nut on the feed screw, and causes it to swivel as the feed screw nut is traversed back and forth. The feed screw nut may need to be specially made, or it may be possible to simply screw a double eye into the existing nut.

In any case the new parts to be made are simple and inexpensive and will enable any shop to handle this job at a much cheaper cost than is possible by any other available means where the cost of the tooling has to be absorbed in the machining of only one pedestal.

In action the pedestal is clamped to the lathe bed at the right height, and with its vertical center line in the same plane as the center line of the pin on which the ring swivels. The cutting tool is then clamped in the ring, projecting as required to cut the desired diameter. Actuating the boring bar feed screw in the usual way, while the bar is revolving, will cause the point of cutting tool to travel in a truly spherical path. From experience a tool constructed and operated as above described I am satisfied that it will produce spherical holes at least equal in both quantity and quality to that produced by any other known device.

IN THIS ISSUE

IT IS highly probable that from now on business will make increasing use of a science heretofore regarded with so much reverence that it has been left almost wholly for the use of professors and politicians. We refer to the more or less known science of economics. Our first article in this issue, "Obstacles to Business Revival," by Nathaniel R. Whitney is an economic article that furnishes a very fair and accurate analysis of present day conditions. By it we are told what are the causes for the present depression and that they will gradually be removed by the growth of certain reforms now under way. Chief of the causes, or in other words the obstacles to business revival, are declining prices (including a lack of uniformity in the relative rates of decline of various commodities), scarcity of capital, and the immense burden that we are carrying in the way of bills payable. Set against these obstacles are the following reforms that indicate improvement: A growing conservatism and a reawakened interest in thrift and industry, potential new construction, successful operation of the Federal Reserve system, and increasing collection and use of business statistics. Retrospectively, we shall no doubt be able to appreciate that conditions such as pertain at present have had their value in showing the way to a desirable amount of conservatism and thrift and in bringing about a recognition of the necessity for comprehensive statistics as guides to the organization and successful conduct of a business.

The second article this week is a description of the monitor-type shop, the newest building of the Lodge & Shipley plant. Of particular interest are the methods of obtaining light, draining the roof and heating the building. There are to be articles on other new shops from time to time, so that opportunity will be given for comparison of designs, methods of lighting and layout. Page 1030.

The seventeenth of W. R. Basset's modern production articles, page 1032, takes up the matter of handling abnormal expenses, explains the making of monthly adjustments in accounts to take care of fluctuations, and normal and abnormal expenses and costs.

You will not be surprised that Dowd and Curtis are still on the subject of drill jig design because you know that much ground remains to be covered. The eighth installment, page 1037, considers templet, plate and closed jigs in general and gives examples of open jigs for a shaft and a pump cover, which have been chosen as typical. The next subject taken up will be milling fixtures and we promise that the high standard established in the articles already published will be maintained. Just as it is true that many of the general principles brought out in treating the subject of drill jig design will be used throughout the series, so will many additional principles be brought out in the articles on milling fixtures that will be applicable to fixtures for other operations such as profiling, splining, etc.

Coming Features

About one-third of the editorial section of our next issue will be devoted to series articles, among them "Tool Engineering" and "The Foreman and His Job." There will also be the second of Manchester's "A History of Post War Crises." The first of this series was published in our issue of June 9.

Among the complete articles will be one by Roland W. Sellew and H. R. Reynolds of the Fafnir Bearing Co. furnishing a comparison of various types of ball bearings. Stanley will be represented by a railroad article dealing with locomotive driving wheel axles and crankpin work.

With the matter of machining connecting rods freshened up by the Rolls-Royce article this week, we are going to run next week an article taking up another method of machining connecting rods. The method described will be that used in manufacturing the rods for the White motor.

Some little time has gone by since we published a Rolls-Royce article. This week we are presenting one dealing with the connecting rod, page 1041. Editor Colvin has, with his usual care, described the entire manufacture of the rod. You will be interested in checking the methods used with those which we have previously described that are part of the system of wholly American concerns.

We recently published a story on work done at the Puget Sound Navy Yard. There are several more in process and we have one in this issue, page 1044. The current article deals with boring, blading and assembling ship turbines; cutting blades and packing pieces from strips; and standardizing the design of special machines.

Beginning on page 1046 there is an article by Western Editor Hunter that describes various multiple spindle drilling and tapping machines made by the Defiance Machine Works. They are single-purpose machines designed for intensive production and serve to show the effect on machine tool design of methods required in the manufacture of automobile parts.

The railroad article this week is short, but is none the less instructive, dealing as it does with clamping fixtures for boring mills, gang work on the planer, boring driving blocks and similar subjects.

The reader should not overlook the short articles such as the discussion of a previous article on wet grinding, the statement on the war work of the Bureau of Standards, and the report of the S. A. E. committee on standards for roller chain sprockets.

EDITORIALS

Facing Facts

THE only optimist whose opinions are worth listening to is the one who has made a study of the facts and weighed the good against the bad before forming his opinion. Baseless optimism is only a shade less objectionable than confirmed pessimism. It is often more dangerous to the community.

In times of business depression economic factors, business trends, trade indicators and all sorts of more or less reliable commercial barometers are watched and consulted with almost prayerful eagerness. "When will business pick up?" is the universal question. The question might perhaps not be so vital if we gave equal consideration to such matters when business is booming, but with human nature constituted as it is, it seems likely that we will learn little from our present troubles.

Unfortunately, all the facts in the business problem are not known by every one and many men have not the ability to make a logical analysis of those they do know. Their training has been along other lines and they are too close to their own troubles. With this condition in mind we have secured from Professor Whitney, of the University of Cincinnati, the article which opens this issue. The author does not mince matters and he gives due prominence to the adverse factors that are delaying our recovery, but his conclusions based on mature deliberation are distinctly favorable. We urge that the article be read carefully all the way through. Hasty inferences drawn from the unfavorable factors only are unjustified and can do no good. We Americans are too prone to make snap judgments—hence this word of warning.

"Full Speed Ahead"

PRESIDENT HARDING'S slogan for business, "Full Speed Ahead," is typical of the attitude of the new administration toward business and business men and is in marked contrast to that of the late unlamented administration. In his speech at the one hundred and twenty-fifth anniversary banquet of the *New York Commercial*, the President not only paid a fitting tribute to the achievements of the business press in support of American business, but took advantage of the opportunity to bring a message of encouragement to the business men of the country.

The message came at an opportune time. A frank statement of the desire of the administration to do all in its power to stimulate business, it did much to dispel the cloud of uncertainty which has been covering us. There was a vital need for clearing up the doubts that existed in the minds of business men, for they hesitated to act until they were sure of the attitude of official Washington, just as the buyer in a falling market holds back until he thinks the bottom has been reached.

If we could be as sure of the good sense and interest of Congress as we are of the intentions of the Administration we should feel decidedly complacent. Unfortunately we are unable to do so while our political system places so many demagogs, cheap politicians and briefless lawyers in legislative positions. The able men are far too few and they are greatly hampered by the obstructionists and class representatives with whom they have to struggle.

Another factor that militates against the successful functioning of the average congressman is that he feels that no sooner is election over than he must shape his course for the next one two years distant. As a result he spends valuable time in open or covert electioneering that should be devoted to his legislative duties.

We can but hope for the best and each one let his representative at Washington know that the policy of the Administration toward business is right and should be supported.

The Need of Airplanes

THE wreck of the Army plane carrying seven people is regrettable in every way—the more so because had we been more wide awake to the needs of air travel it could probably have been avoided. Yet we must not forget that the same kind of disaster occurs at sea, even though we have had centuries of experience in building and navigating vessels of various kinds.

So far at least, man has never been able successfully to defy the elements, even on land, when wind and rain and electrical energy are let loose by the god of storms. So it is not surprising that aircraft should fall a victim to the fury of such a storm as caused the wreck on Decoration Day.

Two things are necessary to prevent the repetition of such disaster: Landing fields at much more frequent intervals and a system of wireless communication so that planes can be instantly apprised of storms and warned to land or directed how to avoid them, just as is now done in the case of shipping. And just as we have laws which require radio apparatus on certain grades of ships, so we can prevent passenger carrying in planes which are not so equipped.

The main thing, however, is to realize our opportunity to develop air transportation and the aircraft industry. Handley Page, the well-known English airplane builder, tells us that we have the greatest opportunity in the world to develop air transportation because of the size of our country and the absence of annoying custom houses as is the case in the small European countries. But we must first realize that the industry cannot thrive on indifference and that it must be treated as a method of transportation and not as a means of entertaining crowds at county fairs.

It is time for the Chamber of Commerce of every city to secure adequate landing fields and co-operate in securing wireless service for warning and control. It is also time for serious consideration on the part of the builders as to the production of aircraft at a moderate price. A Henry Ford in the airplane industry would do much to further the use of aircraft, to secure landing fields, instruments and all the other things which we so badly needed.

Shop Equipment News

Robertson "Economy" High-Speed Power Saws

The W. Robertson Machine and Foundry Co., 56 Rano St., Buffalo, N. Y., has recently placed on the market the "Economy" No. 400 portable hacksaw, shown in Fig. 1, and intended for either hand or power drive. It can be used as a general utility saw in the shop when fitted

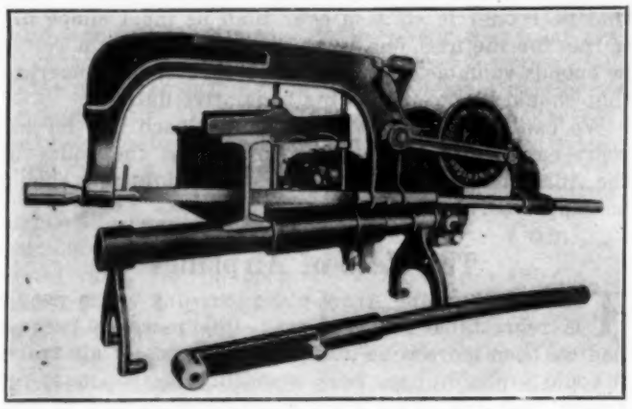


FIG. 1. ROBERTSON "ECONOMY" NO. 400 PORTABLE SAW

with the two legs as shown. By removing the front leg, it is suitable as a rail raw for use on street railways, where the current is taken from overhead. The electric current is ordinarily taken from a lamp socket, but where it is not available, the machine may be driven by hand by means of the lever shown lying in front of the saw, after connecting the lever to pins on the crank disk and on the frame.

The machine has a maximum capacity of 8 in. and uses 17-in. blades. The motor is mounted on a bracket supported on the bed and drives the crank disk through worm gears running in oil. Gravity feed is used, and a lever engaging a stud is provided for holding up the saw while clamping the work.

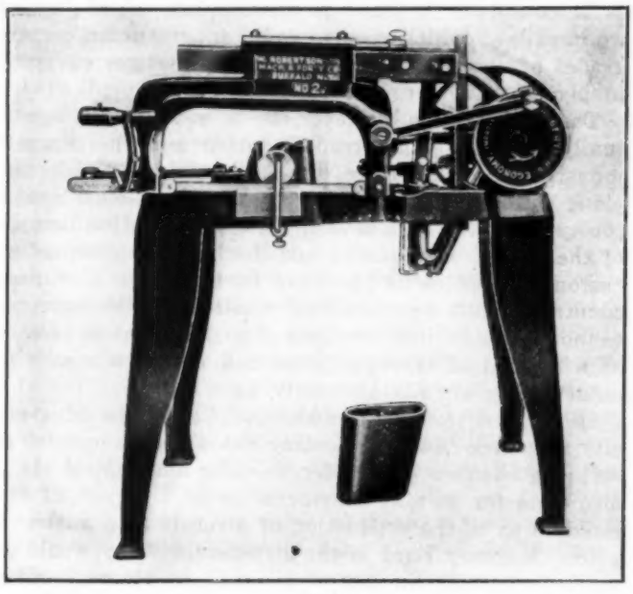


FIG. 2. ROBERTSON "ECONOMY" 1921-MODEL NO. 2 POWER SAW

The 1921 model of the No. 2 "Economy" power saw is shown in Fig. 2. This machine, which is a draw-cut saw having a capacity of 6 x 6 in., has been equipped with an oil lift of the type employed on larger machines made by the concern and intended for relieving the teeth of the blade from the work on the idle stroke.

The oil-lift device consists of a two-cylinder pump submerged in oil contained in the tank shown removed and placed beneath the machine. One plunger is timed with the crankshaft, the other being connected to the saw frame. At the end of the cutting stroke the plunger connected to the crankshaft is on the down stroke, which forces the oil under the plunger connected with the frame, thus raising the saw from the work. At the beginning of the cutting stroke, the pump timed with the crankshaft has just passed a port allowing the oil to escape, thus allowing the frame to lower while on the cutting stroke. It is said that the lift greatly decreases saw breakage.

The machine is equipped with a swivel vise for cutting angles up to 45 deg. It is driven through a friction clutch and stops automatically when the cut is completed.

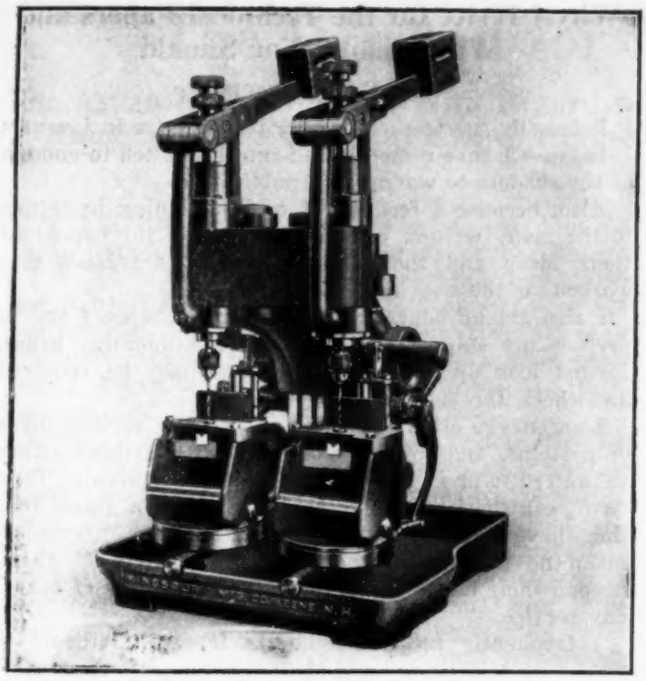
Kingsbury Automatic Pin-Drilling Jig

The Kingsbury Manufacturing Co., Keene, N. H., has recently placed on the market a pin-drilling jig for use with the two-spindle automatic sensitive drilling machine made by the concern and described in the *American Machinist* on page 1066, Vol. 53. The jig operates in conjunction with the drilling machine so that the operation is completely automatic, the accompanying illustration showing the jig adapted to drilling the crossholes in small pins, rivets or screws.

When the operator pushes the pin to be drilled in place into the small V-block at the top of the jig, the spindle is released from its position at the top of its stroke and starts to travel downward, the pin being automatically locked in place at the same time by the turning of a cammed roller. While the drill is cutting a stream of coolant is delivered to its point. At the completion of the hole the spindle rises and the work is unclamped and ejected automatically. The spindle stops at the top of its stroke until it is released by the replacing of another pin in the jig.

Probably the most important feature of the machine, and the one which permits of continuous operation without drill breakage, is a mechanism, used when drilling comparatively deep holes, which raises the drill when it is part way through the work, so as to relieve the point of the chips. This mechanism consists of a cam with a grooved periphery to replace the grooved eccentric ordinarily used on the machine.

The rate of production of the pins, of course, varies with their size. It is stated that cold-rolled steel pins $\frac{3}{32}$ in. in diameter were drilled with a No. 53 high-speed drill at a production rate of 15 pins per minute

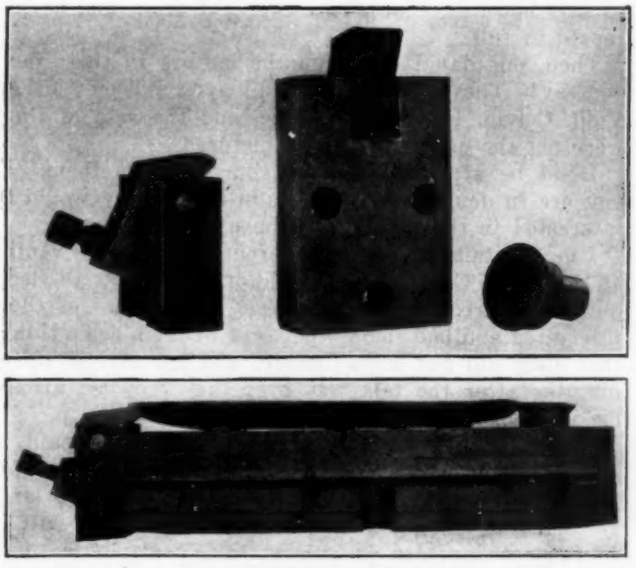


AUTOMATIC PIN-DRILLING JIG IN PLACE ON KINGSBURY DRILLING MACHINE

per spindle, 1,200 pins being drilled between grindings of the drill. It is said that a production of 1,500 pins per hour can be easily maintained by the use of two spindles.

Cincinnati Engineering Tool Co. Holding Dogs

The special dogs shown in the accompanying illustration have been placed on the market by the Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio, for use on first-operation fixtures. At the top of the illustration are shown two sizes of the



CINCINNATI ENGINEERING TOOL CO. HOLDING DOGS AND THEIR USE ON A FIXTURE

adjustable dogs, while one size of the stationary dog is shown on the right. The lower part of the illustration shows the smaller adjustable dog and the stationary dog in position on a fixture, illustrating their use in holding work. The adjustable dogs with their holders are made of case-hardened machine steel and the stationary dogs are made of hardened alloy steel.

The advantages of the method of holding the work by means of the dogs are said to be as follows: The fixture can usually be designed and built very cheaply, due to the simple pattern and small amount of machining. The fixture is easily cleaned, as there are no projecting walls which hold chips in it. The work can be clamped close to the finished surface, which is especially advantageous when work has a large rounding and is difficult to hold in any other way. The adjustable dog positively clamps work down on the locating points, and does not cause the trouble incident to the use of a setscrew on which the point is slightly eccentric; that is, lifting the work from the locating points instead of clamping it down.

Fritz Werner A. G. Hardness-Testing Device

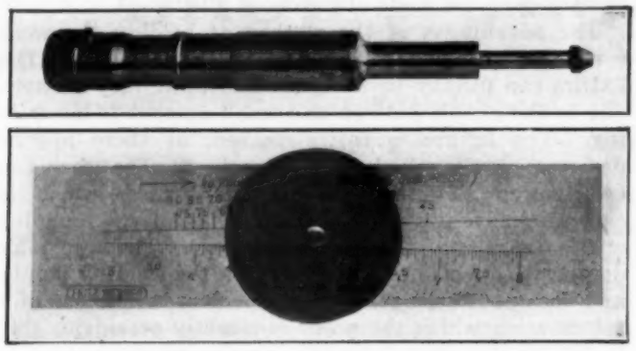
A portable hardness-testing instrument, operating on the Brinell principle, and not confined in its use to testing rooms, but which is intended for workshops and stockrooms, has been put on the Continental market by Fritz Werner A.-G., Berlin, Germany. Hardness tests in Germany are more or less confined to large firms, but this portable instrument is intended to supply a testing-tool at low cost and suitable even for the small manufacturer.

The maker does not claim high accuracy for the device, but that it fulfills all practical requirements. The tool is of simple design, making its handling easy and fool-proof. It can be used for testing stock in place, or set in the machine, not needing special test pieces. The instrument, shown at the top of the accompanying illustration, consists essentially of a tubular casing with its top screwed on, and a plunger carrying the test ball at its end. In the interior of the casing is placed, with ample play, a piston, and between the latter and the top, a spiral spring. The plunger and the piston are connected by a sliding joint, and both parts are held in place by a device which is released automatically at a certain position of the piston in the casing.

When the tool is used, it is held with one hand on the closed end of the casing and one on the other end, and the ball end is pressed against the piece to be tested. Under this pressure the casing is moved forward toward the ball end, against the pressure of the spring between the piston and top. At a given position, the releasing device comes into action, whereupon the piston is moved forward by the spring and strikes against a shoulder of the plunger, producing an impact of the ball end against the piece under test. When the tool is removed, another spring carries the piston back into its starting position. In order to avoid too sharp a reverse movement, the plunger has an air-tight fit in the bushing, producing cushioning of the reverse stroke. The intensity of the blow can be adjusted by screwing or unscrewing the top, thereby contracting or loosening the spring. Once set, the spring can produce several hundred strokes of sufficiently equal intensity, without readjusting.

For ascertaining the hardness of a material, a transparent rule made of celluloid is supplied, showing two lines at a very acute angle, one graduated to read twentieth parts of a millimeter, the other for reading directly the strength of the material, in kilograms per square millimeter. This applies, however, to steel and

malleable iron only; and for other materials tables are supplied. The view at the bottom of the accompanying illustration shows how the rule is applied to a ball im-



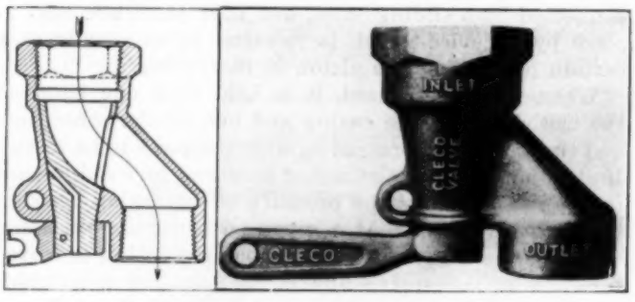
WERNER HARDNESS-TESTING DEVICE AND SCALE FOR MEASURING BALL IMPRESSION

pression. A diameter of impression of approximately 5.45 mm., and a hardness of the material of 42 kilograms per square millimeter are indicated.

"Cleco" Pressure-Seated Air Valve

The Cleveland Pneumatic Tool Co., Cleveland, Ohio, has recently placed on the market the "Cleco" pressure-seated air valve, a view of which is shown on the right side of the accompanying illustration. The maker calls attention to the fact that the conical plug is forced in place on its seat by the air pressure itself.

As can be seen by the sectional view on the left side of the accompanying illustration, packing, gaskets, stems and springs are eliminated, there being only three parts to the valve, the body, the plug and the handle. The air does not come in contact with the seat of the valve, which prevents damage to the seat and the necessity of replacing it. As shown by the arrow marking the direction of travel of the air, the air enters at the top of the valve, passing into the top



"CLECO" PRESSURE-SEATED AIR VALVE

of the hollow plug, and then out of the side of the plug and into the supply line. The turn in the path of the air is slight, so as not to impede the passage.

The valve is provided with a waste arrangement, to allow the accumulated pressure in the air hose to escape to the atmosphere when the valve is shut off. In this way the hose from the valve can be relieved of strain when it is not desired to use the air, thus enabling the operator to disconnect the hose from the valve more easily. It is stated by the maker that the valve has been subjected to severe service tests under both low pressures and pressures as high as 500 lb. per square inch; and that it has operated very satisfactorily and without leakage.

Why I Write for the Technical Papers and Why I Think You Should

By E. F. Creager

Primarily, my reason for writing for trade journals is because I have something of interest to tell to enough of the readers to warrant its publication.

Also, because I feel that I owe something in return to the many writers who have given me the benefit of their ideas and thoughts—their "pet schemes" that worked, or the ones that didn't work.

I also get an education from writing, since I try to present my subject correctly and intelligently; hence, I must look up such information as may be required and check the same for errors.

I encourage others to write about their various ideas or systems, and I have four boys with articles either submitted to or in preparation for trade journals. They have seen "write-ups" by the "old man" of items that they have been using every day and had previously given no thought to the utility or novelty of them, beyond their being useful labor-saving devices of every-day service.

I frequently received requests from the editors to "write up something" and at first I was very much worried for fear some one would make fun of my efforts, or that my sketches would not be in the proper "plane of projection." Then, too, I had an idea that the editors who would "pass" upon the article were a bunch of "high brows" whose only pleasure was to "turn down" an article because the rhetoric or punctuation was not all that it should be. However, one day one of the Associate Editors of the *American Machinist* called on me and it was the beginning of a splendid friendship that has now lasted for over fifteen years. He showed me how. He looked over my private "morgue"; borrowed a lot of it from time to time and had it photographed, and in a short time I had the pleasure of reading a series of illustrated articles on my stuff under the name of E. A. Dixie. Now, the only way I found to keep ahead of him was to write for myself. I wish to say, however, that all he ever got from me, he has repaid in full.

Then, one day I called on the editors in their den; and say! They were only men like you and me; Miller, Viall, Colvin, Halsey, Suverkrop and the rest of them were not the ogres that I had pictured.

Don't be afraid to present your ideas to them. If you are in doubt, write them and ask if they would be interested in the subject you have in mind.

I gave a talk before forty foremen the other evening at the Y. M. C. A. and a couple of them went to sleep, but I am sure that I had at least 75 per cent of them interested and had told 50 per cent of them some things that they did not know before, and for almost thirty minutes after the talk was over they crowded around me in informal discussion of the points taken up.

I have just been informed that my title would be changed from works manager to a higher one and that I would have the mechanical supervision of two large factories producing widely different articles, with a consequent increase in salary, and I attribute much of my ability to fill the higher position and to hold a member's certificate in three of the largest engineering societies, to information gained from trade papers and engineering journals or proceedings.

So look around, boys, and see if you can't find some wrinkle of interest and send it in.

The Demand for Machinery in India

The Aryan Is Enterprising With Regard to Machinery — Industrial Concerns Are More Numerous Than Generally Known Here—There Are Possibilities of Big Developments

BY GEORGE CECIL

WITHOUT going so far as to say that the possibilities of the machinery export trade to India are unlimited, one is justified in stating that it has before it a promising future. Every year developments are taking place. The rich native of twenty-five years ago is giving place to a more enterprising Aryan, who puts his money into manufacturing undertakings.

Many of the shares in the Bombay Cotton Mills and in the Calcutta Jute Mills are held by Mahometan and Hindu capitalists, and the same applies to the various sugar and paper mills of Hindustan. And, not only do England's Eastern subjects take an interest in existing industrial concerns, but they launch out on their own account, by erecting jute and flour mills, stone crushing mills, cotton presses, bone mills, printing presses and engineering works, while occasionally a stray Eurasian is equally venturesome.

Payment Necessary Before Shipping

It may be added that, whether the colored man of means be wholly or partly black, machinery and engine makers would do well to secure payment before shipping the goods, for the Oriental is notoriously "slim," be he the possessor of millions or only of thousands of rupees. "Cash against documents" does not necessarily result in the shipper receiving his just dues, since the purchaser is quite capable of declining to take delivery of the consignment on finding that he is expected to pay for it.

Tea-Garden Machinery

Another outlet for machinery exists in the planting districts. For, though in the indigo centers a horizontal engine of obsolete mechanism and a few wooden screw presses answer the purpose, among the tea-garden community there is quite a demand for the more modern productions of engineering firms. Indeed, from here is sent many an order to the eight or ten structural engineers of repute, who, in addition to a dozen or so of lesser importance, exist in India.

Mention also may be made of the various general merchants who stock machinery, or who are not too proud to act as agents for its sale. Among them are Gillanders, Arbuthnot & Co.; Anderson, Wallace & Co.; Ahmutty & Co.; Balmer, Laurie & Co.; Barry & Co.; Bird & Co.; and Turner, Morrison & Co., all of Calcutta. India's capital also possesses a number of shipbuilding and repairing yards, while in Bombay a few foundries and importers of engines and machinery carry on business. In fact, all over the country ironmongers, jute and cotton merchants, wine merchants and the like are only too glad to turn a timely rupee by undertaking an agency for the sale of 500-hp. mill engines, cotton-spinning machinery, and even mowing machines and sewing machines.

One of the curious things about Anglo-Indian commerce is that the cobbler cannot be induced to stick to his last. The tea-broker thinks it necessary to dispose of tea-drying machines, and the insurance agent is not happy till he has succeeded in obtaining an agency for the sale of driving belts, lubricating oil, and gas engines. In addition to the outlets mentioned, there are the "shops" in connection with India's railway companies, of which there are about thirty. A considerable amount of machinery is imported by them. It may be added that they each possess a London office.

India Has Many Industrial Enterprises

The following information with regard to the precise number of machinery-using concerns in India will perhaps be of interest. Of tea companies there are about 230, of indigo concerns some 280, and of bone-crushing mills three or four. Four wool mills exist; twenty-four tanneries, of a somewhat assorted nature; fifteen sugar factories, several of which are by way of being in a more or less moribund state; and a dozen saw-mills. Of roperies there are twelve, of paper mills nine; whilst India possess over sixty linseed- and castor-oil mills and twenty or thirty jute presses.

There are some thirty jute mills, nineteen foundries, twenty-four ice works, and ten gold-mining companies—which are now resting on their laurels. Of breweries there are nineteen, and of rum distilleries eleven; whilst of coal companies, cotton mills, and cotton presses there are, respectively, fifty-five, one hundred and forty-seven and forty-seven. Added to this there are hundreds of small printing presses, several horse and steam tramways, mica works, and numerous other small enterprises using machinery. It can be seen that the diversity of industries is even greater than one would expect to find.

India is also rich in contractors and municipalities, the last-named requiring steam-rollers and water-works machinery. There are several local lines of steamers running between Calcutta and Bombay, and Calcutta and the further East. Calcutta is, moreover, rich in steam-launches; whilst electric installations have made their appearance in that city and in Bombay.

Scarcity of Practical Engineers

The majority of mills and machinery-employing concerns in India are under the superintendence of an expert machinist or engineer. But the small jute presses, steam tramways, cotton presses, oil mills, printing presses, and so forth, are in charge of stupid Eurasians, or equally unsatisfactory natives. The result is that the machinery often comes to grief, owing to the manager of the works paying but scanty attention to it. Hot bearings are of frequent occurrence, and the engineer, in his ignorance, often blames the maker.

It may be observed that in India the sale of machinery is seldom arranged without an aggravated form of secret commission passing between the salesman and the buyer, should the last-named be an employee and not a principal. This is just one of the peculiarities of the Indian method of trading, which the American manufacturer shipping there must learn and study before he is able to export to India with success.

Declarations of Principle of Manufacturers Association of Connecticut, Inc.

The Manufacturers Association of Connecticut, Inc., Hartford, Conn., has subscribed to a set of declarations of principles concerning industrial relations and industrial management. A booklet containing them has been published by authority of the board of directors and the executive committee. The declarations are:

(1) We believe in fair dealing.

(2) We believe in good faith in the matter of agreements and contracts.

(3) We believe that men and women should receive equal pay for service of equal value rendered under equivalent circumstances.

(4) We believe in proper constructive legislative regulation and control.

(5) We believe in the enforcement of the law.

(6) We believe in the proper regulation of night work for women.

(7) We believe in the proper regulation of child labor.

(8) We believe in the proper regulation of any occupations injurious to the health and morals of workers.

(9) We believe in healthful and safe working conditions.

(10 We believe in the guidance of entry into, and training for, industry.

(11) We believe in compatibility of occupation.

(12) We believe in the use and development of methods of determining the character of work to which individuals are best suited with a view to their greater service, growth, prosperity and contentment.

(13) We believe in opportunities for technical training and education, individual development and progress.

(14) We believe that industry should provide methods of self-expression suited to the individual or class concerned.

(15) We believe in freedom of opportunity of any individual to learn or engage in any trade or profession or occupation to which such individual may be adapted.

(16) We believe in an opportunity for mental growth commensurate with the capacity therefor.

(17) We believe in an opportunity for advancement proportionate to growth.

(18) We believe in adequate wages proportionate to productivity, work done, or service rendered.

(19) We believe in systems of pay that recognize and provide an incentive for increased production or service.

(20) We believe in proper methods of study, investigation and research to determine the relation between productivity and reward.

(21) We believe that every worker should have an opportunity to earn a wage proportionate to his ability, skill and productive capacity.

(22) We believe that capital is entitled to a return proportionate to the services rendered and the risks run.

(23) We believe that capital is the friend and not the enemy of labor and that the interests of both are common.

(24) We believe that employers and employees must avoid selfishness and recognize mutual considerations, obligations, opportunities, responsibilities and benefits.

(25) We believe that the human factor in industry deserves first and primary consideration.

(26) We believe that the working hours should be adjusted to the character of work and working conditions, with due regard to health, morals and social private life.

(27) We believe in the progressive improvement in working and living conditions, and further believe that our modern industrial and social order is conducive to such improvement.

(28) We believe in a proper American standard of living.

(29) We believe that health, happiness, prosperity and contentment result from earnest and sincere productive effort and hard work by all, with an appropriate measure of leisure, recreation and rest, accompanied by proper living conditions conforming to moral, hygienic and sanitary laws.

(30) We believe in the open shop.

(31) We believe in the right of both employers and employees to organize where such organization is committed to proper purposes and pursues proper methods.

(32) We do not believe that membership in any organization is essential to social fellowship.

(33) We believe that the employee has a right to leave employment when he sees fit and that the employer has a right to discharge any employee when he sees fit, each with due regard to agreements or contracts.

(34) We believe that employers should be free to engage employees at wages and hours mutually satisfactory without interference or dictation on the part of individuals or organizations not directly a party to the arrangement.

(35) We believe that employers must have freedom in the management of their business, subject to the provisions of law, justice and equity.

(36) We believe that the employer must have full discretion to determine the methods of work and the competency of industrial workers.

(37) We believe that employers and employees should seek to bring about regularity and stability of employment.

(38) We believe in a peaceful settlement of disputes between employer and employee.

(39) We believe in the utilization of the knowledge, ability and special skill of all classes of industrial workers and of society.

(40) We believe in progress and improvement in processes, methods, efficiency and organization.

(41) We believe in the encouragement and utilization of inventions and improvements.

(42) We believe that the management of any industry should be so constituted as to make possible and encourage the consideration of the rights of all individuals and classes engaged in such industry, and where the problems, benefits, responsibilities and opportunities are mutual, there should be the opportunity for mutual consideration thereof without reference to the mechanism by which this is accomplished, it being understood that such mechanism may and should be adapted to the particular and peculiar conditions existing in such manner as to bring about the most cordial relationship, compatible with mutual efficiency and confidence and the discharge of obligations and responsibilities.

(43) We believe that efficiency is essential to the growth and progress of modern industry and industrial opportunity for all, and that such industries cannot continue and grow in the mutual interest of all concerned without reasonable and relative efficiency corresponding to the standards of the age, and we are opposed to any system or mechanism that destroys, obstructs or makes impossible such efficiency. Where it is necessary for the maintenance of such efficiency, the interests of all must be merged and placed under the control of those most competent in the exercise thereof. We do not believe that any class can permanently retain such control in modern industry without consideration and recognition of the interest of others.

(44) We believe that increased production at greater efficiency means a correspondingly greater return for the industrial worker, an increase in his purchasing power and an increase in the wealth of the nation, which only those who help to produce should share.

(45) We believe in the constructive development of our American democratic system of public education.

(46) We believe in the encouragement of agriculture as a means of reducing the cost of living and promoting the welfare and prosperity of the country.

Some of the things the association is opposed to are enumerated as follows:

(1) We are opposed to the closed shop.

(2) We are opposed to coercion or intimidation.

(3) We are opposed to violence, destructive agitation, class wars, revolutionary socialism, lawlessness, disorder.

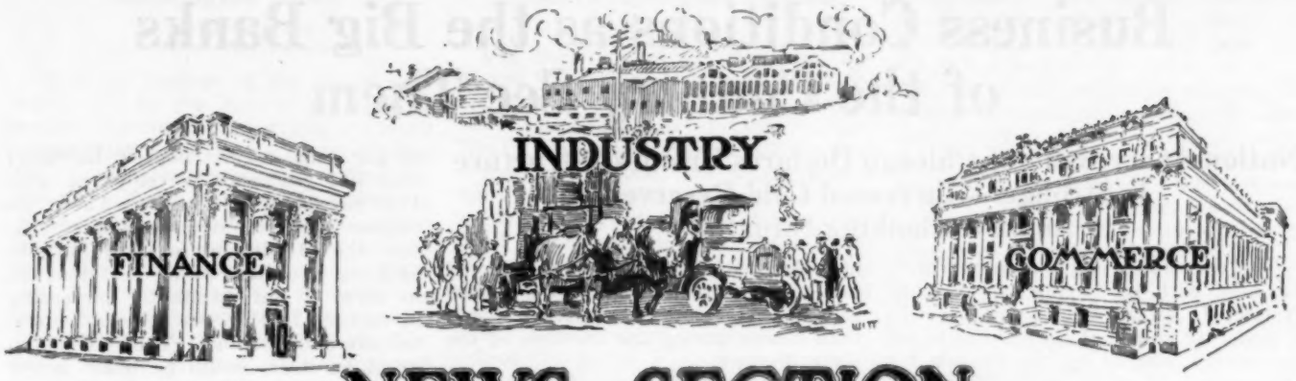
(4) We are opposed to boycotts, blacklists, lockouts and illegal acts of interference with the personal liberty of employer and employee.

(5) We are opposed to limitation of output or production.

(6) We are opposed to excessive leisure because it prevents a reasonable measure of productivity and is liable to lead to social evils.

(7) We are opposed to over specialization.

(8) We are opposed to despotic or autocratic treatment of the matter of human relations.



NEWS SECTION

Patent Amendment to Protect American Industries

In the interest of the national defense and to prevent unwarranted advantages to foreign inventors, Senator Stanley, of Kentucky, has proposed an amendment to the revised statute providing that any patents issued to foreigners must be put in operation, and that production in reasonable quantities begun within the continental limits of the United States within two years. Failure to comply with that provision entitles the United States to issue a license which will permit use of the patent.

The legislation, Senator Stanley states, is intended to prevent such a situation as arose at the outbreak of the war when the United States was cut off from supplies of dyes which were made only in Germany. German interests had American patents covering more than 1,000 coal tar products. Had these interests been required to manufacture their products in the United States, American industries depending on them would not have been paralyzed. Senator Stanley points out that practically every other nation has a law requiring compulsory production, within the country, of patented articles taken out by foreigners.

Monster Plans for Pageant of Progress at Chicago

The latest news coming from the headquarters of the Pageant of Progress Exposition, to be held in Chicago on July 30 to Aug. 14, indicates a world-wide interest in this novel undertaking. Plans for the event are being worked out and most of the exhibition space has been taken up. There will be three and one-half miles of exhibitions, taking up the entire floor space of the famous Municipal Pier, which extends 3,000 ft. into Lake Michigan.

The exhibitions will show the progress made in all lines of industry, agriculture, and the arts and sciences. Special features will include boat, airplane, automobile and carrier pigeon races, naval and military sham battles, receptions by the foreign consuls and representatives and numerous other events.

Machinery Exhibit at Rouen, France

An exposition which should be of interest to American manufacturers of loading and unloading machinery, will be held at Rouen, France, during the entire month of July. The new port works at Rouen have just been completed and will eventually be in the market for machinery of this kind. The exposition is in charge of M. l'Ingenieur de la Chambre de Commerce, Rouen, France.

Some Data on Corrosion of Sheet Duralumin

Under the direction of the Bureau of Standards, Washington, D. C., an inspection has been made of corroded duralumin in the form of thin sheets used in the construction of all metal airplanes. The material became brittle in service owing to the development of intercrystalline "cracks" evidently as a result of corrosion. The attempt was made to produce the brittle condition in portions of the sheet which apparently were still ductile. By corrosion alone as well as by the simultaneous action of corrosion and stress, it was possible to develop intercrystalline brittleness in the specimens. Annealing of the material, annealing followed by slight cold rolling and severe cold rolling of the commercial stock did not appear to affect materially the corrosion. In this case it appears certain that the deterioration was the result of the corrosion of the sheet. Brittleness developed because of corrosion from both acid and neutral solutions but an alkaline attack did not appear to cause the development of brittleness.

Detroit-Cleveland Steel Merger

At a meeting of the stockholders of both companies, to be held on June 24, a proposal will be submitted for a merger of the Detroit Pressed Steel Co., of Detroit, Mich., and the Hydraulic Steel Co., of Cleveland, Ohio. New stock will be issued in the new company. The Detroit company manufactures frames for automobiles and Disteel rims and brake drums.

World Finance at London Conference

A trial balance sheet of the world's financial condition, taking into account the amount Germany agreed to pay in reparations to the Allies, will be one of the American contributions to the first conferences of the International Chamber of Commerce to be held in London during the week of June 27. Other contributions will be a survey of world communications, a review of economic conditions in the United States, reports on ocean transportation, fabricated production, distribution, raw material production, port facilities and a comprehensive summary of American railroad practices in making international shipments to Canada and Mexico. All these reports are now being prepared by committees made up of leading American business men.

Some two hundred delegates from all parts of the United States will attend the conference. Representatives from the eleven constituent countries will be in attendance at the meeting. Walker D. Hines, formerly director general of the United States Railroad Administration, will be chairman of the group for transportation and communication.

Industrial Y. M. C. A. at Bayonne

In an effort to bring about a more general application of the golden rule in industry, a large and completely equipped Y. M. C. A. has been established in Bayonne, N. J. The project was started some time ago and the recent dedication of the building was the culmination of a campaign undertaken by the industries of Bayonne to provide a means of healthful and educational recreation for its thousands of workers.

Among the industries which backed up this enterprise were the Standard Oil Co. (N. J.), Tide Water Oil Co., Babcock & Wilcox Co., International Nickel Co., Vacuum Oil Co. and the Pacific Coast Co.

More than 75 per cent of the operating expense will be cared for by membership fees and other income from those who use the building. For every dollar contributed by the employers for operating expenses, the employees will invest three dollars.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Declares Business Structure Is Stronger—Increased Gold Reserves Improve Banking Situation

The country is doing a conservative business with its buying power much restricted. In the West there has been a moderate gain, but the volume is not impressive, judged by the records for this season in other years. However, the cost of doing business is declining, and the price structure is materially sounder than it was a year ago, or even six months ago. This is an important achievement and shows that orderly deflation is eliminating many of the evils from which the country suffered so seriously during the inflation period. The chief problem still has to do with bringing about such a reduction of retail prices as shall secure for the consuming public the benefits growing out of the drastic cuts in wholesale commodity prices. This readjustment is progressing, and will receive greater impetus in the future, as the public is determined to force down the average merchandise level by refraining from doing business at the quotations of war days. Concessions in steel prices have not attracted much buying yet, as consumers believe that lower quotations are inevitable for an industry which is now operating at scarcely 40 per cent of capacity. It has been estimated that general business throughout the country is just about half what it might be with the industrial machinery fully employed. This is by no means true of all industries, however, for increased activity is being shown in leather and a few other lines.

Good Progress

The reduced buying power of the country districts contrasts sharply with the larger sales reported by retail stores of the cities, as a result of the strong efforts being made to reduce high priced merchandise stocks and to pay off, or to reduce long standing indebtedness. There are signs of improvement in the foreign demand for pork, flour, wheat, cotton seed oil, and other products and with the abandonment of war-time food regulations abroad, it is probable that this buying will enlarge with ultimately heavily increased sales to German markets. This will be a great help, since Germany before the war made large provision purchases in the United States and a resumption of large-scale buying of this character would be of material benefit to the Southwest.

The outstanding fact is that the recuperative powers of American industry are enormous and with the banking position as strong as it is and commodity prices 48 per cent below the high level of last year, the folly of taking a bearish position on the United States is even more apparent today than it was during the life-time of the elder Morgan.

Strong Reserves

The tremendous over-subscription to the United States Treasury's recent $200,000,000 offering of short-term certificates of indebtedness shows that there is an abundance of funds awaiting temporary investment at 5½ per cent if offered by a borrower of the highest credit. The gain in the country's banking position has been progressive, so that the increase in the reserve ratio of the combined system on May 18 last exceeds 14 per cent compared with a year ago. The ratio of gold reserve to Federal Reserve notes in circulation, after setting aside 35 per cent against deposit liabilities was 70.4 per cent as compared with 47.2 per cent last year. These increases are very striking and emphasize the steady improvement in the banking situation which is fortunate, in view of our constantly increasing investment in Europe's restoration and salvage undertakings. The gold inflow, great as it is, would be much larger were it not for the export embargoes still in force in various European countries. One of the most interesting problems of the moment has to do with a proper utilization of our enormous gold reserve. Constant efforts are being made to get the Federal Reserve Board to let down the bars and through extending the time for certain obligations to lengthen the life of paper rediscounted by the reserve banks. These entreaties are natural under the circumstances, but the situation calls for strong handling, for all nations are looking to this country to rally to the support of the gold standard and to preserve it for the rest of the world.

Some Light on the Money Situation by the National City Bank of New York

Nine-tenths of the erroneous thinking about money is due to confusing money as a medium of exchange with capital. Money is a convenience in effecting the exchanges but it does not take the place of capital. The money question always has been a subject of controversy, and it is not easily elucidated in all its details, but there are certain broad propositions which most people are able to grasp, and which when agreed to will dispose of many of the most plausible fallacies. It is a safe rule in the business world not to try to get something for nothing, and in the world of applied science not to try to get more out of any combination than the sum of all that is put into it. By the same reasoning it is safe to conclude that a people cannot make themselves rich by printing money or by any other scheme for making credit take the place of capital. There is a hole in every such proposition somewhere.

False Prosperity

It does not stand to reason that the unproductive expenditures which the United States made on the war could be the basis of a higher permanent level of prosperity than it had ever known before. Real prosperity comes by an increase of the supply of wealth which one way or another contributes to the well-being of the population, and the expenditures upon the war do not come under this description. And yet a great many people who considered that they were very prosperous during the war and in the two years following, are convinced that that state of prosperity might have continued indefinitely if the bankers had not arbitrarily restricted the manufacture of credit. They do not see that a settlement day need ever have come, or that a reaction was inevitable.

Temporary Affluence

It does not seem that the broad proposition needs to be argued. It must be agreed that war-time prosperity in the main is fictitious, and that those who actually improve their position do so at the expense of others. Normal relations were violently disturbed, with the result that some were gainers while others were losers, and many were temporarily deceived into thinking themselves gainers when in fact they were not. A good many people were consuming principal when they thought they were living on income, and many were happy and wasteful under conditions which could not possibly be lasting. The people who gained unearned profits by the sudden rise of prices should have known that such a disturbance of normal conditions involved the probability of a reverse movement, and all those whose incomes increased faster than their accustomed expenditures should have known that this was a temporary gratuity at the expense of the letter-carriers, school teachers and millions more whose expenditures increased while their incomes were unchanged or increased in smaller degree.

Washington Notes

By Paul Wooton
(Washington Correspondent)

With the passage of the second deficiency bill by the Senate, the Department of Commerce is certain to receive the $500,000 asked by Secretary Hoover for the specific purpose of aiding industry. Of the amount, $250,000 will be expended in an effort to encourage foreign trade. The remainder will be utilized in various types of investigation and research looking to simplification, standardization and improvement in industrial practices and devices. The detailed plans for expending this money in the most effective way possible now are being worked out. As this is written, the bill still is in conference, but no great amount of difficulty is anticipated in harmonizing the differences between the bill as passed by the House and as it finally emerged from the Senate. That the President will sign the bill is a foregone conclusion as he has expressed himself on several occasions as favoring such legislation.

Track Laying Vehicles

The Ordnance Department is concentrating some of its best brain power on the problems involved in motorization of the army. It is recognized that animal traction is a thing of the past and that a mechanical substitute for the horse must be developed, not only for artillery use but for the transport of men, munitions and equipment. The problem would be relatively simple if operations were to be confined to good roads. To develop vehicles of various types that will negotiate a rugged terrain and at the same time be capable of high speed, both on and off roads, as well as having some types possessing sustained navigating ability has placed monumental problems before the ordnance transport division.

Experimental work in the elimination of the wheeled truck gives great promise. There is every reason to believe that great improvement can be made in track laying machines and in the track mechanism. Work is being done looking to the ready conversion of standard four-wheeled trucks into track layers.

Must Be a Change

The work has gone far enough to demonstrate that there must be revolutionary changes in the present type of tracks. The difficulties of lubrication and the very high power losses, when high speeds are obtained, must be overcome. Some experiments have shown power losses as high as 36 per cent at a speed of 16 miles per hour. Experiments are being made with hollow track shoes filled with oil but it is doubtful if a satisfactory lubrication system will be devised for the present type of tracks. Preliminary tests have been made of tracks made largely of fabric belting. These are quite successful on small vehicles. Somewhat similar tracks made of steel cables, to which are attached suitable shoes, are now in process of construction.

Dayton-Wright Gets Airplane Award

The Secretary of the Navy has approved the final awards under the navy competition for ship-board airplanes. The first award goes to the Dayton-Wright Co., whose designs will be purchased for $16,000; the second award went to G. Elias & Bro., Inc., who will receive $10,000 for their design; the third award was to the Curtiss Airplane and Motor Corporation, whose design will be purchased for $5,000, and the fourth award was made to Alexander Klemin, whose design will be purchased for $3,000.

The board states that in its opinion, while useful information has been obtained from all five designs and the competitors have shown a praiseworthy zeal in attempting a difficult problem, that the designs of the Dayton-Wright Co. and G. Elias and Bro., Inc., are sufficiently promising to warrant experimental construction at this time, and the board recommends that negotiations with these firms be made at once with a view of arranging a contract for the construction of sample airplanes for experimental flying tests on ship-board.

It is expected that these planes will solve the difficult problem of providing the navy with ship-board planes for taking-off and landing on ships and also on the surface of the water.

Wage Changes Since 1914

Authoritative information on the course of wage changes in the major manufacturing industries of the United States during the past six years, compared with changes in the cost of living, together with data regarding the number of workers employed and the average hours worked per week are made public in a report issued by the National Industrial Conference Board, 10 East 39th St., New York. This report, covering fifteen representative industries, employing in June, 1920, 539,113 wage-earners, traces the movement of average actual earnings in the principal industrial occupations from September, 1914, to the end of 1920, compared with changes in the cost of living as ascertained by separate extensive investigations made by the board.

In December, 1920, the report says, average hourly earnings of male employees in the industries reporting ranged from 127 to 198 per cent, and those of women employees from 111 to 192 per cent above the September, 1914, level. In certain industries the hourly earnings of men increased relatively more than those of women—this was true in the boot and shoe, cotton, wool and silk industries. In the hosiery and knit goods, rubber and metal industries the percentage of increase for women since the beginning of the war was greater than the percentage increase for men. It was found generally true that the industries in which the least increase took place are the ones in which the wage rates were relatively high in 1914, while the industries showing the greatest increases are those which before the war paid relatively low wages.

Some of the industries showing the largest percentage increases in average hourly earnings of men workers are the wool, leather, cotton, hosiery and knit goods industries, while women in wool, hosiery and knit goods, cotton and paper manufacturing showed the greatest increases over 1914.

Average weekly earnings for men and women, the report shows, in general increased less than hourly earnings. The range of increase in weekly earnings from September, 1914, to December, 1920, was from 77 per cent in the rubber industry to 159 per cent in the chemical industry; for women the highest increase was 157 per cent in hosiery and knit goods, and the lowest was 71 per cent in the boot and shoe industry.

The period covered by the board's investigation includes the industrial depression which began to develop in the spring of 1920 and with increasing force continued for the remainder of the year. This depression showed itself in irregularity and sharp fluctuations of wages in several industries, due partly to the uncertainty as to future business conditions and partly to the elimination from time to time of wage-earners with low wage-earning capacity.

In June, 1920, the number of men employed in eleven of the industries covered was 404,094 and in December, 304,678, a decrease of 24.6 per cent; the number of women decreased about 26 per cent in this period.

Average weekly earnings, the report states, were affected more than hourly earnings by the industrial depression in the latter part of the year 1920. The principal cause of the decline in the average was the widespread adoption of part-time operation made necessary by the reduced market demand. Reduction of wage rates, though of less importance, was a contributing factor to the decline.

The course of average hourly earnings during the last seven months of 1920 was affected by a number of influences, some of which operated to raise, while others tended to lower the average, the report says. There was a tendency of hourly earnings to remain steady, or in some cases to rise, even after weekly earnings had begun to decline through part-time employment. As the business situation became more acute general wage reductions were made in a number of industries.

The investigation indicates that in the eleven major industries for which data from 1914 is available wages—as measured by hourly earnings and to a smaller extent as measured by weekly earnings—rose somewhat more rapidly than the cost of living, up to the spring of 1920. Since then hourly earnings have declined generally parallel with the fall in the cost of living. Weekly earnings have, however, fallen more rapidly than living cost since September, 1920, for the industries covered.

First Report of American Engineering Council's Committee on Elimination of Waste in Industry

The first report of the committee on Elimination of Waste in Industry was made to the American Engineering Council at the St. Louis meeting, June 3. It is understood that comprehensive statistics were not included in the report. The following paragraphs indicate some of the general conclusions reached by the committee.

Waste results from an interruption of production, low production, restriction of production and lost production. The wastes of interrupted production result from idle men, materials, plant and equipment.

Large inventories of raw materials and finished product and unbalanced production are causes of waste resulting from idle materials; large sums of money are invested in idle equipment and over-equipment; and factory buildings in many instances are larger than necessary.

Ill health and industrial accidents figure as the causes of lost production, the findings as to which are summarized as follows: The economic loss in this country annually from preventable disease and death is over $3,000,000,000; 42,000,000 persons gainfully employed lose 350,000,000 days from illness and disease and non-industrial accidents annually; 42 per cent of the waste of ill health is preventable; in 1919 there occurred in industry 3,000,000 accidents resulting in an economic loss to the country of about $853,000,000; industrial accidents are caused by the carelessness of the workmen and a lack of ordinary safeguards; authorities agree that it is possible by using methods already perfected, to reduce deaths and serious accidents in American industry by at least 75 per cent.

Trade associations should be formed in those industries lacking comprehensive organization; greater co-operation and publicity should be established within certain industries by improving and increasing the effectiveness of existing grade organizations; there should be recognization of the importance of the collection and distribution of trade information; trade associations should realize their opportunity to promote programs for the standardization of cost accounting methods, the introduction of standardized material specifications, the establishment of production standards, the standardization of equipment and the standardization of finished products; these associations should establish greater co-ordination of activities and relationship between interdependent and intradependent agencies and organizations; the associations should encourage industrial research; industrial trade councils such as have been established here and abroad are worthy of careful study; a nation wide system of employment exchanges should be established and maintained.

The building industry was said to be about 60 per cent efficient; the shoe industry 65 per cent; the average plant in the metal trades group was considered to be from 25 to 30 per cent behind the best plant in output per employee.

The committee consisted of the following men, headed by J. Parke Channing, of New York, as chairman and L. W. Wallace, executive secretary of American Engineering Council; Herbert Hoover, of Washington; L. P. Alford, New York; George D. Babcock, Syracuse; F. C. Colburn, Philadelphia; Morris L. Cooke, Philadelphia; Harrington Emerson, New York; Ira N. Hollis, Worcester, Mass.; E. E. Hunt, Washington; C. E. Knoeppel, New York; Robert Linton, New York; Fred J. Miller, New York; H. R. V. Scheel, Passaic, N. J.; J. H. Williams, New York; Robert B. Wolf, New York.

It is anticipated that there will be made available before long a fuller report which will include the statistics gathered by the committee and information as to how the general conclusions that are reported in this article were reached.

Charles Piez Addresses Engineering Advertisers

"Advertising and Selling from an Executive's Viewpoint," was the subject of an address delivered before the meeting of the Engineering Advertisers Association, of Chicago, held in the Great Northern Hotel, Chicago, on June 7. Mr. Piez, who is president of the Link-Belt Co., and wartime director-general of the U. S. Shipping Board, brought out some interesting and instructive information which, backed up by years of personal contact with big business, was thoroughly enjoyed and appreciated by the "ad" men.

Steel Treaters Convention and Exhibition

Colonel A. E. White, national president of the American Society for Steel Treating, has made some announcements in regard to the annual convention and exhibition of the society, which will be held this year at Indianapolis, Ind., on Sept. 19 to 24.

One of the features will be the awarding of gold and silver medals to the best and second-best papers presented at the meeting.

The Meetings and Papers Committee has been appointed: It comprises Prof. H. L. Campbell, George O. Desautels and Victor Hillman.

1921-1922 Officers of American Supply and Machinery Manufacturers Association

NELSON A. GLADDING, President — IRVING W. LEMAUX, 1st Vice-President — JOHN C. RUF, 2nd Vice-President — S. D. BALDWIN, 3d Vice-President

At the triple convention of machinery dealers and manufacturers, held at Atlantic City, N. J., on May 16, 17 and 18, the American Supply and Machinery Manufacturers Association elected the officers shown in the panel above. Mr. Gladding is vice-president and sales manager of the E. C. Atkins Co., Indianapolis, Ind.; Mr. Lemaux is secretary and treasurer of the Indianapolis Brush and Broom Manufacturing Co.; Mr. Ruf is an executive with I. B. Williams & Sons, Dover, N. H.; Mr. Baldwin is president of the Cincinnati Rubber Manufacturing Co., Cincinnati, Ohio.

Effect of Coal Strike on British Iron and Steel Trade

Wilbur J. Page
Trade Commissioner, London, England

While the effect of the coal strike on all industries in Great Britain has been serious, its influence on the iron and steel trade has been most marked.

The first two months of this year showed little change in the British iron and steel trade, owing to the fact that there was a sufficient quantity of old contracts, placed previous to November, 1920, to keep the industry running fairly well. Early in March a distinct slump all along the line became noticeable. So great was this slump that, while on Dec. 31, 1920, there were 274 blast furnaces in blast, on March 31, 1921, there were only 119 furnaces in blast.

With production already dwindling and prospect of cheaper prices of coke, the blast furnaces were buying fuel from hand to mouth during the month of March. The coal-strike threat developed rapidly, and the threat was carried into effect on April 1. Blast furnaces immediately were damped down by the score, owing to the uncertainty of the outlook and the shortage of fuel, with the result that on Saturday, April 16, from the best figures available, it could only be determined that five blast furnaces in all Great Britain were in operation. As a natural consequence of this the pig-iron trade is to all intents and purposes suspended for the time being. What little business is being done consists of deliveries of small lots from old stock.

Unfortunately, just at the time the coal strike started, the British pig-iron industry was beginning to show some signs of activity. The last cut in the price of Cleveland foundry iron of 30s. per ton, bringing the price of the standard No. 3 G.M.B. down to £6 per ton, should have stimulated domestic inquiry, had it not been for the industrial upheaval. In fact, buyers did show increased interest, especially in those cases where they found their stocks somewhat short and they wished to insure against being caught empty handed in the event of a sympathetic strike of the railway men and transport workers. But this recovery in interest lasted only a few days, and the past week witnessed a complete stagnation in the domestic as well as in the foreign demand for British pig iron.

Foreign Competition

Manufacturers of pig iron are naturally reluctant under present abnormal conditions to quote for business, and buyers are influenced by the same reason to place their orders with Continental works. French and Belgian interests are taking full advantage of the situation to secure orders that might under ordinary circumstances go to British manufacturers. To meet the 30s. reduction in Cleveland foundry iron the Continental manufacturers immediately reduced their prices.

Belgian foundry iron is now being offered c.i.f. in the Tees, or in Scottish ports, at about £5 10s. per ton. This competition is particularly serious as regards Scotland, which is the best market for Cleveland foundry iron, due to the fact that it costs 18s. per ton on an average to ship Cleveland iron to Scottish destination by rail, while there is an additional charge of 2s. 6d. per ton for loading. This simply means that No. 3 Cleveland foundry iron costs, delivered in Scotland, £7 0s. 6d. per ton. It is true that the Continental iron is not equal in quality to the Cleveland iron, but it satisfies the requirements of the average buyer quite well.

The international situation as regards reparations from Germany practically confines the competition from the Continent to France and Belgium. Furthermore, it seems not unlikely that the British colonies will pass legislation affecting the importation of German material similar to that already passed by Great Britain. With this possibility in view, there has been a general suspension of buying from Germany for export to the colonies, although German prices of pig iron are on a competitive basis as regards other Continental works.

Future of British Pig-Iron Production

A great many of the producers have accumulated large stocks of pig iron manufactured at very high cost. Under present conditions these stocks are moving slowly. It is estimated that in the Cleveland district alone there is a minimum of 150,000 tons of high-cost pig iron. There is, however, a shortage of No. 3 Cleveland foundry iron, and this will be just the particular grade of pig iron that will be most required when there is a normal resumption of business. Under these conditions, even if the coal strike should be settled immediately, it will be some weeks before the majority of the blast furnaces will be put into operation again. Producers of pig iron will certainly hesitate to start production until their existing high-priced stocks have been liquidated to a greater extent and until they feel assured that pig iron can be produced once more on an economic basis. There is no doubt that the slump in the prices of pig iron has resulted in their reaching a point which is far below present-day production costs. This slump has been more spectacular in its rapid decline than any period of advance in prices.

Manufactured Iron and Steel Stagnant

Everything is at a standstill in the manufactured iron and steel industry. The question of further reduction in prices is held in abeyance awaiting the outcome of the coal strike. It is felt that under present circumstances further reductions would not stimulate demand, and that it is advisable to wait until the strike is over and there is definite information as regards future fuel costs on which to base further action as regards prices.

While everything depends on future costs of fuel, the trade generally recognizes that further reductions in prices must come if they are to even maintain a portion of their domestic market against foreign competition. Belgian prices for finished iron at the present time are far below any British prices, which are based on actual production costs. The sale of British common iron bars against Continental prices is impossible, while British manufacturers of gas strip steel are also feeling the inroads of Continental competition very keenly.

Most of the finished iron and steel plants throughout the country and the rolling mills are closed down. Occasionally there will be found a single department in a large steel plant in which a few men are still employed, but with the increasing shortage of coal there is bound to be a general shutdown in the trade by the end of this month.

Decimal Bill Again Before Congress

A coalition of western and southern Senators, without respect to party, has determined upon a legislative program which, it will insist, must be embodied in the legislative plan of the congressional leaders. Most of the measures deal strictly with agricultural matters, although the list includes Senator King's proposition for decimal divisions of English measurements, the pure paint bill and the truth in fabric bill.

Senator King's weights and measures bill was before Congress at the last session, but was not given consideration by the Committee on Standards, Weights and Measures. It provides that the English foot is to be divided into ten parts, each to be known as a decimal inch. The one-hundredth part of a foot is to be called "the line" and the one-thousandth part of the foot is to be known as "the point." In like manner other decimal sub-divisions are provided.

It was admitted by the Senators in charge of the conference that a change in the existing system of weights and measures is not regarded as an important part of the program and that the matter was included simply that there might be some committee consideration given to the question. Senator Ladd, of North Dakota, chairman of the subcommittee which made the recommendations, states that he is inclined to favor the metric system of weights and measures but that his idea in selecting the King bill simply was done in the hope that the general subject would receive some consideration.

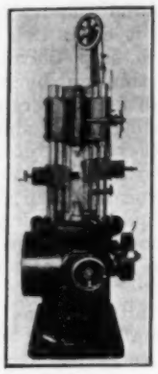
Welcome the "Dart"

We are in receipt of a copy of the first issue of the *Dart*, the house organ of the Medart Patent Pulley Co., of St. Louis, Mo. The magazine is edited by F. E. Chandler and its pages are full of live and interesting reading matter.

Condensed-Clipping Index of Equipment

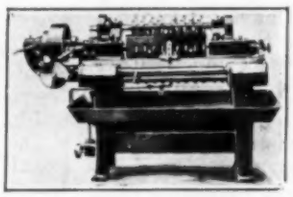
Patented Aug. 20, 1918

Lathe, Vertical.
Cadillac Tool Co., Detroit, Mich.
"American Machinist," March 24, 1921



This machine is intended for quantity production work on such parts as automotive pistons, one of its chief advantages being the saving of floor space. It is essentially a single-purpose machine, and is semi-automatic in its operation. It has a swing over the carriage of 9 in., and a maximum distance between the centers of 16 in. The bed and column are a single box casting, the reservoir for the coolant being incorporated in the base. The driving mechanisms for both the spindle speeds and the tool feeds are enclosed in compartments cast on the bed. The tailstock can be removed on the column by means of a rack and pinion. Two tool carriages, one for turning and one for facing, are ordinarily used, being mounted on the side bars and bearing on scraped ways.

Lathe, Cam-Turning, Melling
Walcott Lathe Co., Jackson, Mich.
"American Machinist," March 24, 1921



The machine is intended for the turning of the cams on automotive-engine camshafts, so as to eliminate the process of rough grinding from the forging. It consists of a flat bed on which is placed all of the mechanism for turning the shafts. A "master cam" shaft is placed at the back of the machine at the same height as the shaft to be turned and is exactly reproduced, all of the cams on the rough shaft being turned at the same time. Spring press the cutting tools against the work. While the cams are being turned the work table moves the camshaft, so as to feed the tools across the faces of the cams. The machine is semi-automatic in operation.

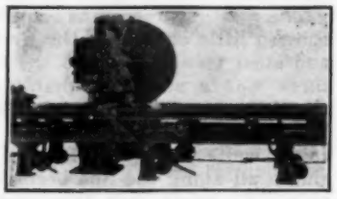
Shear, Angle, Steel, "Chicago"
Dreis & Krump Mfg. Co., 2909 S. Halstead St., Chicago, Ill.
"American Machinist," March 24, 1921

The device is similar in principle to the slitting shear made by the same concern and described on page 392 of the *American Machinist*. The frame and base are made of one piece of pressed steel. A geared lever actuates the upper shear blade, which is reversible and has two cutting edges. The upper blade can be raised high enough to allow the angle to be inserted from the front of the machine. The maximum capacity of the machine is for angles 1½x1½x⅜ in. in size. The length of the base is 9 in., and the height of the frame is 8 in. The handle is 25 in. long, and the weight of the shear is 22 lb.

Grinding Machine, Cutter
Bilgram Machine Works, 1217 Spring Garden St., Philadelphia, Pa.
"American Machinist," March 24, 1921

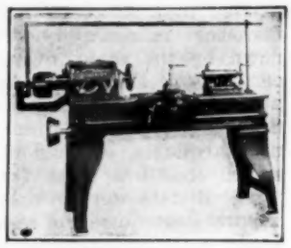
The grinding of the prismatic cutting tools used on Bilgram bevel-gear generators, ordinarily performed on a surface grinder, is done on the ends only of the cutting tools. The rectilinear movements of a standard surface grinder are approximated in this machine by movements of levers in circular arcs. The grinding fixture for holding the tool is clamped in an upright position upon a table below the wheel. Two levers control the movement of the table. Fixtures for use in grinding milling cutters and rotary gear cutters can be furnished with the machine.

Table, Spacing, Semi-Automatic
Cleveland Punch and Shear Works Co., Cleveland, Ohio
"American Machinist," March 24, 1921



The table can be applied to either vertical open-gap punches or multiple punches. It can be used for plates, angles, beams or other structural shapes, and it has a capacity up to and including 24-in. beams. The machine has a runway 100 ft. long and a table that will handle pieces up to 50 ft. long, although both these parts can be furnished in lengths to suit the requirements. The table is propelled along the runway by a push-button-controlled motor that drives through double friction clutches. The correct pitch or spacing of holes is obtained automatically. The table travel is stopped by dynamically braking with the motor.

Lathe, Geared-Head, Production
Sebastian Lathe Co., Cincinnati, Ohio
"American Machinist," March 24, 1921



The lathe is made in 13 and 15 in. swings, and is similar to the engine lathe made by the same firm and described on page 1065, Vol. 52, of the *American Machinist*. The lead-screw assembly and other parts are not furnished, however. The lathe is fitted with a plain toolrest for doing plain turning. It is furnished with a friction pulley. No countershaft is needed, as the machine can be connected up direct with the line shaft. It can be furnished with either a 4½, 5 or 6 ft. bed.

Counterbore, "Cutwell"
Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass.
"American Machinist," March 24, 1921

The device has only two lips, placed helically on the body of the tool. It is stated that the tool makes chips of the same sort as cut by a drill, thus permitting of very rapid work. The space between the lips allows of easy sharpening. The body of the cutter is solid, being circular between the lips. Different mountings, tapers and pilots can be furnished to suit the special conditions of the work. The tool is made in standard sizes, and is said to be adapted to the performing of counterboring on a production basis.

Coupling, Flexible, A. E. G.
Algemeine Electrizitäts Gesellschaft, Berlin, Germany.
"American Machinist," March 24, 1921

The coupling consists of two main parts. The bell-shaped outside part is made of one piece in the smaller sizes; but for larger sizes it is made of two parts screwed together. The inside part has five or more oblong projections, and the outside part an equal number of shoulders on its inner surface. To each of these projections and shoulders a flat piece is bolted, thus holding strips of leather belting connecting the projections. When the drive is in one direction one half of the leather strips is in action, transmitting the force by tension; and when the motion is reversed the other half comes into action. The coupling can be used for any drive, but it is best suited for electric drive, as it is insulating.

Clip, paste on 3 x 5-in. cards and file as desired

National Research Council Funds for Scientific Research

The Research Information Service of the National Research Council has recently compiled information about funds for scientific research. From this compilation it appears that there are hundreds of special funds, trusts, or foundations for the encouragement or support of research, in the mathematical, physical and biological sciences, and their applications in engineering, medicine, agriculture and other useful arts. The income from these funds, which amounts annually to at least fifty million dollars, is used principally for prizes, medals, research scholarships and fellowships, grants and sustaining appropriations or endowments.

So numerous have been the requests to the Research Council for information about sources of research funds, availability of support for specific projects and mode of administration of particular trusts or foundations, that the Research Information Service has created a special file which it is proposed to keep up to date in order to answer the questions of those interested in such funds. Furthermore, in order to give wider publicity to the immediately available information about research funds, the council has issued a bulletin under the title "Funds Available in 1920 in the United States of America For The Encouragement of Scientific Research."

Inquiries concerning the bulletin or for information about research funds should be addressed, National Research Council, Information Service, 1701 Massachusetts Ave., Washington, D. C.

Open Shop After Eight-Month Strike

After a strike lasting for nearly eight months, union machinists, helpers and blacksmiths employed by the McDonough Manufacturing Co. of Eau Claire, Wis., it is reported, have voluntarily called off the strike and offered to return to work on an open shop basis. The strike was called after the union had made demands for a 12½ per cent increase in wages.

The McDonough company has rehired the best workmen among its striking employees, but did not replace any of the men who helped to re-open the plant last October, after it had been shut down for nearly two months by the strike.

Westinghouse Business by Wireless

An interplant wireless communication service was formally opened on May 31 by the Westinghouse Electric and Manufacturing Co., with the establishing of communication between the East Pittsburgh plant and the Cleveland foundry. Besides the Cleveland and East Pittsburgh factories, the Springfield, Mass., works, and the Newark, N. J., works are being equipped with stations for the transacting of company business.

Business Items

The Phoenix Manufacturing Co., Eau Claire, Wis., is now promoting the manufacture of some special garage machine tools. The project is being conducted under the supervision of J. G. Worker, vice-president and general manager, and I. B. Roland, sales manager.

The Union Gear and Machine Co., Boston, Mass., has been purchased by C. W. Sayce and C. L. Pratt, who have been connected with the Boston Gear Works for many years. Mr. Horne, formerly owner of the Union Works, will still retain an active position under the new management.

The Spray Engineering Co., Boston, Mass., has moved its offices to 60 High St., in that city. The factory and shipping department will remain at the old address, 70 N. Washington St.

The Motch & Merryweather Machinery Co., of Cleveland, Ohio, has taken over the sales of the Gordon cam turning lathe, which is now being manufactured by the Willard Machine Tool Co., of Cincinnati, Ohio.

The Harrisburgh Corporation has been organized in Harrisburg, Pa., to manufacture the "Farmotor," a late model of tractor. The plant of the Harrisburg Foundry and Machinery Works has been secured and a board of directors has been chosen. Production will be started at once.

Stockholders of the Morgan Engineering Co., Alliance, Ohio, at a special meeting authorized the board of directors to increase the capital stock of the company from $3,000,000 to $5,000,000.

Stockholders of the Defiance Machine Works, Defiance, Ohio, have authorized an increase in the dividend rate, on preferred stock, from 7 to 8 per cent and $300,000 of preferred and $3,000,000 of common stock, will be offered to the public. The Defiance Machine Works, capitalized at $5,000,000, was organized several years ago by Peter Kettering. His sons C. H. and R. P. Kettering are president and vice-president respectively. The plant manufactures special wood working and metal working machinery.

Through the efforts of the Chamber of Commerce the "Little Giant" motor truck will be manufactured in Geneva, Ohio. The H. B. Young Motor Truck Co., of Euclid, Ohio, has bought the plant of the Geneva Canning Co. where the truck will be made.

The Central City Machine Co., Syracuse, N. Y., has moved its plant from 103 Decker St. to 121 Pearl St. An automobile cylinder reboring machine will be made as a stock product. No change has been made in the organization.

The Andover Machine Co., of Boston, Mass., has recently been organized and incorporated to engage in the manufacture of machinery. The capital stock of the concern is $120,000. Ivar L. Sjostrom, of North Andover, Mass., is president and treasurer, and Mr. Sjostrom, together with Clarence L. Newton and A. M. Nolan, are directors of the company.

The Reserve Co., of Boston, Mass., has recently been organized and incorporated under the laws of the Commonwealth of Massachusetts, to sell machinery, tools, etc. The officers are James H. Marshall, Brookline, Mass., president and treasurer; Winthrop O. Coffin, Brookline, Mass., and Morris Hudnut, Boston. These three also constitute the board of directors.

Automobile tools and parts will be manufactured by the Triangle Steel Products Co., of Michigan City, Ind., a newly organized concern. H. C. Jostes, C. A. Kurrash and L. J. Finske, all of Michigan City, organized the company with a capital stock of $150,000. The company plans to begin production this summer.

The Augur-Perry Co., of New Haven, Conn., has been incorporated with a capital stock of $50,000 to engage in the hardware and tool business at New Haven. The incorporators of the company are E. M. Augur, W. E. Perry, G. H. Bishop and J. H. Dockendorff, all of New Haven.

The Maxf Grinding Wheel Corporation, of Chester, Mass., and the Cortland Grinding Wheel Co., of Cortland, N. Y., have combined interests and the wheels of the two companies will be made at the Chester, Mass., plant in the future. The Cortland plant was destroyed by fire last November. The officials of both concerns will remain in their present capacities.

The Master Tool Co. has been organized under the laws of the State of Ohio, to manufacture a new line of pneumatic tools, and will specialize in the reclaiming of all types and makes of same. The officers of the company are: J. Nightingale, president; Charles F. Overly, vice-president and general manager; William Eckert, secretary-treasurer.

The headquarters and general engineering service and sales division of the Champion Engineering Co., manufacturer of electric traveling cranes, has been moved from Kenton to Columbus, Ohio. R. W. Valls is in charge of this office.

The Claypool Machine Co., Claypool, Ind., has been organized with a capital stock of $70,000. Directors named are D. W. Cripe, J. D. Cripe and W. E. Black.

A Bentley and Sons, Toledo, Ohio, have been awarded the contract for installing the machinery in the Government coal station at Mobile, Ala.

The Empire Steel Partition Co. has been organized by a group of manufacturers at College Point, Long Island, N. Y. The company will build hollow steel extensible-type office partitions. Officers of the company are: W. C. Lange, president; H. W. Charmley, secretary-treasurer.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Locknut, "Non-con-cen-tric"
Sevigne Foundry and Machine Co., Nashua, N. H.
"American Machinist," March 24, 1921

This nut is made by cutting a slot partly through it in a plane parallel to the helix angle of the thread. The depth of the cut is so regulated as to pass completely across the hole, stopping at the thread on the further side and leaving the remainder of the nut uncut. The upper part of the nut is then slightly offset with relation to the lower part, the amount of the offset varying with the service to which the nut is to be put. The direction in which the offset is made is of importance, as the nut can be turned in the direction in which the offset is made with comparative ease, although offering resistance varying in accordance with the amount of the offset to a moment in the reverse direction.

Separator, Moisture, Stratton.
Griscom-Russell Co., 90 West St., New York, N. Y.
"American Machinist," March 24, 1921

The separator is intended for use with either steam or compressed air. It is said that water is effectively removed from high-pressure steam entering an engine or turbine, regardless of the velocity and of the quantity of water present. The device is adapted also to the removal of water from compressed air. The collected water can be drained out when necessary from the sump in the bottom of the cylinder. The separator is built in four types, being made of either iron or steel, depending upon the pressure employed. The device is made to fit pipe lines from ¼ to 8 in. in diameter, the sizes below 2 in. having screwed connections and those above 2 in. having flanged connections.

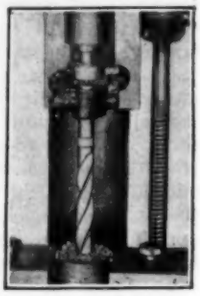
Tapping Machine, Friction-Driven
Anderson Die Machine Co., Iranistan Ave., Bridgeport, Conn.
"American Machinist," March 24, 1921

This machine is intended for use in tapping small parts such as those incident to the manufacture of electrical appliances. It is driven by a ½-hp. motor through the medium of an adjustable friction disk continuously in contact with two friction cones. The surface of the driving disk is shaped as a portion of a sphere, so that any deviation of the motor shaft from a horizontal position changes the relative speeds of the cones. In operation the spindle is lifted slightly by the pressure, bringing the upper friction surfaces together and revolving the tap. When the upward pressure is released by the operator, allowing the spindle to drop into contact with the lower friction disk, the tap is withdrawn at a higher rate of speed. The work can be presented to the tap by laying it on the table and raising the latter.

Table, Indexing
Industrial Engineering Co., 25 E. Fort St., Detroit, Mich.
"American Machinist," March 24, 1921

The device is made in two sizes, with table diameters of 10 and 16 in. A single movement of the handle indexes the table 180 deg. and clamps it to the base, no other movement by the operator being necessary for clamping the table. All working parts are of steel, hardened and ground. The indexing is controlled by a lock which automatically takes up its own wear, and which is claimed to be positive and fool-proof. A keyway is cut across the face of the table for use in aligning jigs or other fixtures, and T-slots are provided for bolting them in place.

Holder, Drill and Reamer, Self-Centering, W. B.
Woodall-Basch Tool Co., 450 Welting Block, Syracuse, N. Y.
"American Machinist," March 24, 1921

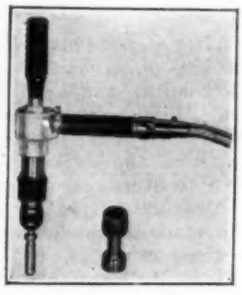


The device is intended for use upon drilling machines, lathes and screw machines, its purpose being to grip the drill or reamer so as to prevent it from turning in the spindle, as well as to center it. It consists of a sleeve having a head, through which a T-slot is milled at right-angles to the center line. This sleeve has a taper hole reamed in the head end, so as to receive a center point, upon which the rear end of the drill or reamer fits. Floating freely in the T-slot is a dog having an elongated hole, in which the shank of the drill is gripped by means of a setscrew. The holder can be furnished in two sizes, the No. 1 having a capacity up to 1-in. shanks and the No. 2 up to 2-in. shanks.

Clamp, Toolmaker's
M. B. Hill, 10 Eden St., Worcester, Mass.
"American Machinist," March 24, 1921

The jaws are pack-hardened and left in the natural color. The fulcrum screw is fixed in the outer jaw and slides loosely through the inner one, a knurled thumb-nut on this screw regulating the position of the inner jaw. The clamping screw is threaded through the inner jaw and bears in a socket in the outer jaw. A steadying pin is also fastened in the outer jaw, and sliding through a hole in the inner jaw, it prevents the latter from turning out of place. Two sizes are made, with 4- and 6-in. jaws respectively.

Screwdriver and Nut-setter, Power Driven, Flexible Shaft
N. A. Strand & Co., 549 W. Washington Blvd., Chicago, Ill.
"American Machinist," March 24, 1921



The appliance is used in connection with the standard type of motor drive and flexible power shaft made by the company. It is made in four sizes, Nos. 4, 5, 6 and 7, requiring motors of ¼ hp. for the two smaller units, a ½ to 1-hp. motor for the No. 6, and a 1 to 2-hp. for the No. 7. The device has two handles so that it can be easily controlled and can be used at any angle. An adjustable tapered friction device may be set by the knurled nut on the sleeve to drive the work with any desired maximum torque. The motor can be furnished mounted on either an iron stand or on a plain cast-iron base.

Burner, Oil
McKneat Manufacturing Co., Easton, Pa.
"American Machinist," March 24, 1921

The illustration shows the oil-burning device for general use in machine and repair shops, foundries and plants where compressed air is available. A vaporizing type also is made, for use where compressed air is not available. The compressed-air type will burn crude oil, fuel oil or kerosene, the fuels producing 1,800, 2,500 and 2,900 deg F. of heat, in the order named. The vaporizing type burns kerosene only. U. S. Standard 12- and 10-gage steel plates are used for the tanks, and all joints are electrically welded and subjected to a hydrostatic pressure of 225 lb. Electric steel castings are used for the back and front heads of the burner tip, which is removable and can be easily replaced.

Clip, paste on 3 x 5-in. cards and file as desired

The National Machinery Co., Tiffin, Ohio, has elected the following officers: M. Frost, president; Mrs. J. K. Rohn, vice-president; Earl Frost, secretary, and W. L. Hertzer, treasurer.

Newly chosen officers of the Boos Machine Co., St. Marys, Ohio, are: President, Louis Stout; vice-president, Albert Herzing, and secretary-treasurer, C. W. Schmehl.

The Carbon Hill Coal Co., of Terre Haute, Ind., has secured leases on a large acreage of Minshall coal, near Rosedale, and commenced sinking a mine last week. A complete coal mining plant will be installed, including tipple, machine shop, forge shop and other mechanical buildings, with power plant for general operations. This will make this mine one of the best equipped in this part of the state.

The Plainville Castings Co., Inc., of Plainville, Conn., is erecting a new iron foundry. General jobbing and contract work will be done. The incorporators are H. S. Washburne, C. F. Conlin and William Stewart.

The Hauck Manufacturing Co., of Brooklyn, N. Y., has elected Henry T. Gerdes as president. Other officers elected were M. C. Hauck, first vice-president; A. B. Hauck, second vice-president; H. H. Kress, third vice-president; A. H. Stein, treasurer, and J. Lutz, secretary. Mr. Gerdes was formerly manager of the Treadwell Engineering Co., of Easton, Pa.

The Meldrum-Gabrielson Corporation, Syracuse, N. Y., will erect a $300,000 factory in that city as soon as plans have been approved. The company manufactures special machinery and tools and in the new plant will take up the production of a heavy-duty milling machine, recently patented by Mr. Gabrielson.

The Steel Fabricating Corporation announces the removal of its factory and offices from Harvey, Ill., to the new plant at Michigan City, Ind.

The Parker Supply Co., Inc., New York City, has been reorganized and placed under the management of the J. G. White Management Corporation. At a recent meeting of the directors the following officers were elected: Walter Rautenstrauch, president; W. S. Bowen, vice-president and treasurer; D. L. Boyd, secretary and general manager. The company will continue its production of Parker sheet metal screws, punches and other specialties.

The growth of business in the Philadelphia district has necessitated the removal of the office and salesrooms of the Combustion Engineering Corporation, of New York, to more spacious quarters in the Finance Building, Philadelphia, Pa. W. C. Stripe is in charge of this office.

E. D. Morton & Co., Louisville, Ky., dealer in general factory and machine shop supplies, has added a machinery department and will carry a full line of machine tools.

The Davis-Bournonville Co., Jersey City, N. J., announces that hereafter all purchases will be made through the office of the works manager, under the direct supervision of H. H. Meixsell. Sales representatives will be interviewed only between the hours of 10:30 and 11:45 in the morning, and 1:20 and 2:30 in the afternoon, with no interviews on Saturdays.

The Repelarc Furnace Co. has been organized at Indianapolis, Ind., for the purpose of manufacturing furnaces and special machinery. The stockholders include E. E. Gates, R. L. Walker, S. W. Huls, N. C. Heuser and J. C. Ralston.

The Martell Packings Co., of Elyria, Ohio, recently completed arrangements whereby it will produce the line of turbine air tools being marketed by the Turbine Air Tool Co., of Cleveland. This line includes drills for wood and metal, grinders, wood planers and groovers, marble polishers, and sanding machines. D. S. Cole, formerly production manager of the Leece-Neville Co., is the general manager.

Personals

FRANKLIN G. HUBBARD, formerly master mechanic of the Western Electric Co., of Chicago, Ill., and more recently associated with the H. E. Harris Engineering Co. and Hubbard & Harris, consulting engineers of Bridgeport, Conn., is now president and mechanical engineer of the Lacey Manufacturing Co., Bridgeport, Conn., which makes a specialty of die and tool work.

J. G. KOEPPEL, formerly engineer for the Saulte Ste. Marie Bridge Co., Saulte Ste. Marie, Mich., has been granted a patent for a new automobile clutch which it is said will make the operation of a car safer and will greatly simplify control.

P. H. WITHINGTON, of Toledo, Ohio, president of the Sparks-Withington Co., has been made president of the Sterling-Knight Motor Co., which will produce a new model Knight six-cylinder car.

Obituary

ALEXIS I. DU PONT, secretary and director of E. I. Du Pont de Nemours & Co., died at his home in Wilmington, Del., on May 31. He was 52 years old.

FRANK H. WHEELER, president of the Wheeler-Schebler Carburetor Co., Indianapolis, Ind., committed suicide in his home on May 31. Despondency over long illness is given as the cause of the action.

WILLIAM A. KYTE, sales manager and member of the board of directors of the Foster Machine Co., Elkhart, Ind., died on May 24. He had been associated with the Foster company since 1905.

New Publications

Employment Methods. By Nathan W. Shefferman, 573 pp. 6 x 9 in. Illustrated by diagrams, drawings and sample forms. Published by the Ronald Press Co., New York City.

One of the thoroughly worth while developments of the stress and tribulation of war has been the growth of interest in and the understanding of employment management and the methods used therein. The author of this book has had a wide experience in his chosen field and is well qualified to talk of employment methods.

The book is divided into five parts, the first of which takes up the function and development of an employment department. Under this general head the author tells the reasons for the establishment of an employment department and its function. He also takes up the duties and qualifications of the employment manager. Part II is devoted to the problem of getting employees. Various types of forms are described as well as methods of interviewing and testing the applicant.

Under Part III, which is concerned with holding employees after they have been hired, the labor turnover problem is attacked from various angles. The different kinds of training for employees are analyzed, wages, transfers and promotions are considered, and absences and discharges are dealt with.

Part IV is headed, "Employing for Office, Store and Bank," and is devoted solely to the office end of employment management. Part V takes up the human element, which is to many people the principal reason for the existence of employment managers. It discusses service work, the medical department, industrial housing and employees' representation systems.

The whole subject is well handled and will give the progressive owner and manager not only a good deal to think about but many practical suggestions as well.

Training Industrial Workers. By Roy Wilmarth Kelly, 437 pp. 6 x 9 in. Illustrated by forms, tables and diagrams. Published by The Ronald Press Co., New York City.

The second of the three Ronald manuals of labor management, as its title implies, takes up the matter of educating and training industrial workers. An excellent introduction has been written by Professor John M. Brewer, of Harvard University, and we can hardly do better than quote a portion of his opinion of this book.

"'Why not try education?' is the question which must occur over and over again to one who studies the adjustments and readjustments of industry. The worker in shop or factory must be brought to see that only through increasing enlightenment represented by education will he be able to solve his life problems, increase his productive power and make progress toward full stature as a citizen.

"Putting industrial problems into the schools and putting education into the factory involve a high degree of co-operation among all the persons concerned. They must make contacts, get acquainted and learn from each other.

"Dr. Kelly's book is written to tell industrial managers and educational directors about the lessons which both school people and manufacturers have learned in shop and factory education, and to show how these lessons can be applied to particular establishments. He brings in review the successful accomplishments in vocational education, with the reasons for their success. He points out the need on the one hand for quick training in skill and on the other for the more fundamental education which shall give knowledge of the correct principles back of successful business and for the development of responsibility.

Whether the reader wants to find out the theory back of successful plans or the actual way to begin he will find his answer."

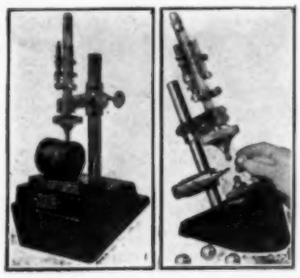
Labor Maintenance. By Daniel Bloomfield, 530 pp. 6 x 9 in. Illustrated by a few charts. Published by the Ronald Press Co., New York City.

This book is the third of the Ronald manuals of labor management. It takes up the principles of the various forms of service for employees, such as safety work, suggestion systems, recreation, housing, plant magazines, Americanization, financial aids, etc., and follows up each with numerous examples of actual experiences with the many different plans that have been tried.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Gage, Micrometer, Fluid, Prestometer, No 5.
The Coats Machine Tool Co., 110 West 40th St., New York, N. Y.
"American Machinist," March 24, 1921



The gage is shown in Fig. 1 equipped for the measuring of pistons. The instrument has a capacity up to 6½ in. and is suitable for marine, truck and tractor engine pistons exceeding 4½ in. in diameter. The total height with the arm in the uppermost position is 22 in., and the width of the cast-iron base 8¼ in. The instrument is equipped with both flat and slanting bases. The size of the surface plate is 6x4 in. The plunger pin is equipped with a detachable ⅜-in. ball. In Fig. 2 is shown the machine equipped with a micrometer, V-type backstop for use in the inspection of steel balls. Removable, loose steel-ball contact points touch the ball from above and below.

Adapter, Chuck, Draw-in
Phoenix Tool Co., 2 Remer St., Bridgeport, Conn.
"American Machinist," March 24, 1921

This self-contained adapter enables the using of spring or draw-in collets in the spindle of an engine lathe or milling machine without the necessity for a draw-bar or for a through hole in the spindle. The illustration shows the adapter disassembled, the parts in the foreground being milling cutters to be held by the device. The thread for drawing the collet is in the body of the adapter and the knurled ring has a pin fitting the spline in the collet, so that the latter may be closed or released by turning the ring. The adapter can be furnished to take any standard spring collet, and the shank can be fitted to any standard taper.

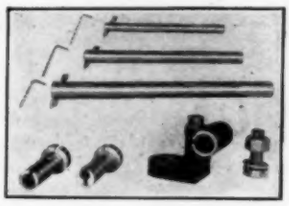
Dressing and Truing Machine, Grinding Wheel, Style 21
Precision Truing Machine and Tool Co., Cincinnati, Ohio
"American Machinist," March 24, 1921

The device can be applied to any surface- or tool-grinding machine. It consists essentially of a spindle mounted on ball bearings and carrying a flywheel on one end, the whole being encased in an aluminum housing. On the other end of the spindle is mounted a small hard grinding wheel. To operate, the device is placed on the table of the grinding machine with the sides of the two wheels parallel. By bringing the faces of the wheels together while the grinding machine is running, the wheel of the device is made to revolve, and the action of the two wheels running together trues and dresses the grinding wheel.

Lathe, Gap, Geared-Head, 74-in.
Canada Machinery Corporation, Ltd., Galt, Ontario, Canada.
"American Machinist," March 24, 1921

The lathe is built with a 27-speed head, 18 of the speeds being obtained through the spindle and 9 through an internal gear on the faceplate. The speed changes are obtained by levers located on the head of the machine, the motor being mounted on top and driving to the head by means of steel and rawhide gears. A friction clutch is mounted in the gearing. The bed may be moved on its base by means of a rack and pinion, operated by a wrench at the rear of the machine. It is supported by a box leg. A thread-chasing dial for indicating the correct point for engaging the nut is mounted on the carriage. A compound pillar rest is provided, with an English toolpost mounted on the extended base. Weight, about 30,000 lb.

Tool Set, Boring, Lathe
Cascade Tool Co., 71 Washington Ave., Cohoes, N. Y.
"American Machinist," March 24, 1921



The illustration shows the standard set for 18-in. lathes, consisting of a holder, clamp bolt, two eccentric spring sleeves and three boring bars, ¾ in., 1 in. and 1¼ in. in diameter respectively. Each bar is fitted with a high-speed-steel bit. An advantage of the tool is said to be the offset in the holder, which can be swung around so as to enable the operator to turn the outside of work that cannot be reached with the ordinary tool. Sets can be furnished in any combination to suit the purchaser, and are made to fit any size of lathe.

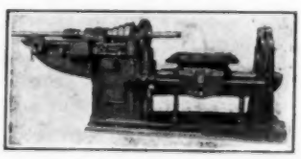
Oil-Grooving Machine, "Sacrey"
Philadelphia Engineering and Machine Co., Philadelphia, Pa.
"American Machinist," March 24, 1921

The machine will cut practically every type of oil groove, including straight, cross, and right- or left-hand helical, on internal and external surfaces. The chuck, which is of the three-jawed scroll type, is attached to two upright steel posts at the top of the machine, and is adjustable up and down to accommodate various lengths of bushings or other work. Work up to 4½ in. in diameter may be held in the chuck body with no overhang, while work up to 6 in. in diameter can be mounted on top of the chuck or held in a special fixture. The stroke of the crank is adjustable from ¼ to 7 in. Feeds are both by hand and automatic. Height, about 4 ft. Floor space, 24 in. in diameter. Net weight, 650 lb.

Drill, Post, Electric
Black & Decker Mfg. Co., 661 Liberty St., Baltimore, Md.
"American Machinist," March 24, 1921

The device adapts a standard portable electric drill to use as a drill press for heavy drilling or precision work. The vertical column or post is a steel shaft 1 7/8 in. in diameter and is clamped to the wall by means of brackets at the top and bottom. The device is adapted to the use of ¼-, ⅜-, ½-, ⅝- and ¾-in. portable electric drills, which can be quickly attached and detached. The table and the bracket carrying the drill can be raised, lowered or swung around on the post. A helical spring returns the drill to the top position when the feed lever is released. The feed lever gives a ratio of 6 to 1. The outfit is adapted to garages, wheelwright shops and general machine shops.

Boring Machine, Horizontal
Machinenfabrik Hinwil, Hinwil, Switzerland.
"American Machinist," March 24, 1921



The machine is intended for medium sized work. The spindle is 3 in. in diameter with a 28 in. length of power feed. It runs in tapered phosphor-bronze bushings, and is fitted with a faceplate having gear teeth and engaging with the single back gear. The back gear and the 4-step cone together give eight spindle speeds, ranging from 9.8 to 250 r.p.m. The boring bar has four power feeds obtained through a quick-change gear box. The work table has power-driven longitudinal, cross and vertical feeds. A safety device prevents the simultaneous engaging of the longitudinal and the cross feeds. Net weight, 6,100 lb.

Clip, paste on 3 x 5-in. cards and file as desired

Like the other two books in the series it gives practical suggestions as well as more or less theoretical discussions of the phases of the labor problem with which it concerns itself.

The author points out the experimental nature of most of the service work that has so far been done and states as his purpose the presentation of the experiences of others to protect the experimenter from the same pitfalls that they have encountered.

Elementary Machine Shop Practice. By James A. Pratt, M. E., director, Williamson Free School of Mechanical Trades. D. Van Nostrand Co., New York. 320 pp. 201 illustrations, 15 tables.

A text book covering the elementary fundamentals of machine-shop practice both as to bench and machine work. The book is well written and the instructions for doing the several classes of work are given with clearness and in detail. Even a layman, after perusal of this book, should have a pretty clear idea of the general way in which work is done in the ordinary machine shop. Diagrams of machines are given together with reference keys and the names of the parts. The contents includes chapters on the following: Bench work; Supplies and Miscellaneous Tools; Hardening and Tempering; Machine Adjustments; Equipment; General Tools; Lathe Tools; The Lathe Back Rest, Follow Rest, Compound Rest; Eccentric Turning; The Drilling Machine; The Shaper; The Slotting Machine; The Grinding Machine; The Milling Machine; Gearing; The Planer; Machine Shop Calculations; Machine Glossary; Course Outline.

Scientific Paper, No. 408. (Effect of the Rate of Cooling on the Magnetic and other properties of an annealed eutectoid carbon steel.) Bureau of Standards, Department of Commerce, Washton, D. C.

Specimens of a eutectoid carbon steel were cooled from 800 deg. C. in air, in lime, and at various rates in a furnace. The effect of these rates of cooling on the magnetic properties, viz., maximum and residual induction, coercive force, permeability, and the magnetic reluctivity relationship, also on the resistivity and scleroscope hardness are shown in tables graphically and their significance discussed. Micrographs illustrating the structure are presented. It is shown that the change in structure from an essentially sorbitic one to "divorced" pearlite causes a gradual shifting of the bend in the reluctivity line and a greater difference between the values of the "real" and "apparent" saturation intensities.

Anyone wishing a copy may have same by addressing a request to the Bureau.

Financial Engineering. By O. B. Goldman, Professor of Heat Engineering at the Oregon State Agricultural College. 271 pp. 6 x 9 in. Illustrated with diagrams and tables. Published by John Wiley & Sons, Inc., New York City.

Starting from the eminently sound proposition that technical engineering must be supplemented by financial engineering to make a complete harmonious system, the author proceeds to develop the theory and practice of the latter art. Although the book is primarily for the practicing engineer it has served admirably as a text book in several courses.

The subject is treated under eight chapter headings: Introduction; Cost Segregation; Fundamental Financial Considerations; Basic Costs; Vestances; Unit Cost Determination; Determination of Size of System for Best Financial Efficiency; Determination of Type and Size of Units.

Many practical examples of cost and efficiency determinations and numerous tables of useful figures for various units and combinations are given. The costs may be reduced to current values by dividing by the relative purchasing value of the dollar today as compared with the dollar of the date for which the figures are given.

Labor Legislation of 1919. Bureau of Labor Statistics, U. S. Department of Labor, Washington, D. C.; four hundred and nine 6 x 9-in. pages.

A general summary and review of labor legislation for the fiscal year ended Dec. 31, 1919. The subject matter covers a wide and varied field, giving some consideration to such matters as wages; hours of work; health and safety laws; insurance, pension and retirement funds; vocational training, and laws enacted to decide labor disputes. A large section of the book is devoted to a review of the individual laws passed by the several states, governing their own particular labor situations.

Pamphlets Received

Our New Place in World Trade: Guaranty Trust Co., New York City. A twenty-four page booklet containing an intelligent discussion of present American trade in foreign countries and a prospectus of the future. Several illustrations help to impress the reader with the ideas conveyed in the text.

Pittsburgh's Industrial Predominance: The Chamber of Commerce, Pittsburgh, Pa. A well-made-up brochure illustrated with several views of Pittsburgh's industrial and commercial centers as well as scenic beauty. The steel works of Pittsburgh, greatest in the world, are given much space, and various other industries are described at great length.

The Centrifugal Creamer: Engineering Foundation, 29 West 39th St., New York City. One of the "Research Narratives," five-minute stories published by Engineering Foundation as a means of stimulating interest in research work. This pamphlet takes up the discovery and eventual perfection of a machine for separating cream from milk by a centrifugal process.

Trade Catalogs

Grand Rapids Grinder Book. The Grand Rapids Grinding Machine Co., Grand Rapids, Mich. Catalog, 48 pages, 8¾ x 11¼ in. describing and illustrating a line of drill grinders, cutters and tool grinders, and tap grinders.

Flexible Shafts and Equipments. N. A. Strand Co., Chicago, Ill. A twenty-eight-page catalog, No. 21, 7½ x 10½ in., describing and illustrating flexible shafts as manufactured by this company.

Portable Welding and Cutting Apparatus. Electric Arc Cutting and Welding Machine Co., 152 Jelliff Ave., Newark, N. J. A fifty-two-page illustrated catalog describing some particulars of portable cutting and welding machines, electrodes, supplies and accessories as manufactured by the above company.

C. H. Magnetic Chucks. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. A fourteen-page catalog describing and illustrating magnetic chucks, also giving the rating of chucks manufactured by the above company.

Grand Rapids Combination and Drill Grinder. Grand Rapids Grinding Machine Co., Grand Rapids, Mich. Circular 8½ x10¾ in. illustrating and describing the combination tap and drill grinding machines; also giving the specifications of same.

Economizer Drinking Fountains. Manufacturing Equipment and Engineering Co., Boston, Mass. A four-page circular illustrating and describing an economizer and drinking fountain having two sets of cooling coils; also a recent price list on all the company's drinking fountains, wash bowls, metal furniture, etc.

Wash Bowls and Lockers. Manufacturing Equipment and Engineering Co., Boston, Mass. A four-page circular describing and illustrating various types of wash bowls, storage cabinets and lockers made by the above concern.

Thor Portable Electric Drills. Independent Pneumatic Tool Co., 600 West Jackson Boulevard, Chicago., Ill. A four-page circular, No. 36, 3¼ x 6¼ in., describing and illustrating the new Thor electric drill stand including complete specifications.

Davis-Bournonville Oxy-Acetylene Apparatus. Davis-Bournonville Co., Jersey City, N. J. A fifteen-page catalog 6 x 9 in., describing and illustrating acetylene generators, welding and cutting torches, pressure regulators, portable outfits and welding supplies.

Starrett Tools. The L. S. Starrett Co., Athol, Mass., Catalog No. 22, 5½ x 7½ in., three hundred and fifty pages describing a complete line of Starrett measuring tools and precision gaging instruments, including rules, protractors, steel tapes, squares, inclinometers, calipers, dial test indicators, micrometers, gages and many types of fixtures and attachments.

Kidd Efficiency Steels. Kidd Drawn Steel Co., Aliquippa, Pa. A 20 x 28-in. table showing the decimal equivalents of fractions of an inch and intermediate sizes of drill rods.

Hydraulic Wheel Presses. The Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Catalog No. 47 illustrating and describing, with full descriptions, a line of different types of wheel presses built by this company.

International Business Machines. International Time Recording Co., of New York, N. Y. A circular just issued describing a line of recording locks, autograph locks, and time recording clocks.

C-H Electric Apparatus. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. A catalog combining several bulletins which contain dimensions with prices, of electric controlling apparatus. The pages are cut for fly-leaf folder and will fit a pocket-size notebook.

Sprague Ventilating Fans. Sprague Electric Works of General Electric Co., New York, N. Y. Two small folders describing several types of electric ventilating fans for stores, homes, factories and offices.

C-H Elevator Controllers. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. This booklet, containing 40 pages, describes and illustrates a line of elevator controllers and accessories, with tables giving motor, fuse and wire ratings.

Trucks. Hyatt Roller Bearing Co., 709 Sixth Ave. at 41st. St., New York, N. Y. This company gives a new truck report covering the advantages and methods of installation of Hyatt bearings for trucks of all kinds.

P & H Shovel Attachment. Pawling & Harnischfeger Co., Milwaukee, Wis. Pamphlets announcing the new shovel attachment for P & H types 205 and 206 excavator cranes.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm of ship repairers in France desires to purchase electric welding outfits, complete, from motor to welders' gloves and face protectors. Quotations should be given f.o.b. New York or c.i.f. French port. Cash to be paid. Correspondence should be in French. Reference No. 34908.

The purchase is desired by a firm in The Netherlands of equipment for factories in France, such as sugar mills, cotton mills, wood and steel working machinery. Quotations should be given c.i.f. port of northern France. Reference No. 34932.

A mercantile firm in Italy desires to purchase bronze valves, iron tubing and fittings, and iron plates. Quotations should be given c.i.f. Italian port. Reference No. 34913.

An inquiry has been received from a man in Jugoslavia for the purchase of several boring machines for petroleum, and also for about 80 miles of pipe line for gas transportation. Reference No. 34917.

Forthcoming Meetings

The 1921 annual meeting of the American Society for Testing Materials will be held at Asbury Park, N. J., on June 20 to 24, with headquarters at the New Monterey Hotel. C. L. Warwick, Engineers Club, Philadelphia, Pa., is secretary.

The eighth annual convention of the American Drop Forge Association and the Drop Forge Supply Association will be held at Chicago, Ill., June 22 to 24 with headquarters at the Congress Hotel.

The American Society for Steel Treating will hold its annual convention and exhibition at Indianapolis, Ind., on Sept. 19 to 24.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

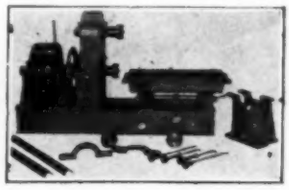
Tractor, Industrial, Gasoline
Reliance Trailer & Truck Co., San Francisco, Cal.
"American Machinist," March 24, 1921

The machine is adapted to both pushing and towing. The wheels are equipped with Timken bearings, and the axles are said to be heavy enough to support a load of 2 tons. A heavy, perforated, steel bumper plate in front protects the radiator. The machine is provided with fenders, running boards, and an upholstered spring seat having a back. The tractor is 6 ft. 6 in. overall in length; 50 in. overall in width; has a 42-in. tread and a 50-in. wheel base. It can turn in a circle 12 ft. in diameter on the inside. The maximum running speed is 11 miles an hour. A five- to six-ton load can be towed by the machine, as built, and the ballast box under the seat can be filled with weights to increase the traction.

Pump, Oil, Rotary, Motor-Driven
S. F. Bowser & Co., Inc., Fort Wayne, Ind.
"American Machinist," March 24, 1921

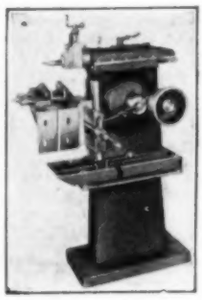
The pump is intended for transferring oil from one place to another, as unloading tank cars. The motor is connected to the pump by means of reduction gears of the herringbone type, the gear being cast iron and the pinion bakelite. The outfit is mounted upon a cast-iron base. The pump is of the rotary type, it being said that it contains only two moving parts, each part being self-supporting and having clearance around it, so that wear and friction are greatly eliminated. The device can be set to automatically by-pass when a predetermined pressure has been reached. The pump is made in seven sizes to fit pipe line from ¼ to 3 in. in diameter. The motors required are from ½ to 15 hp.

Burning-in-Machine, Universal
Canedy-Otto Mfg. Co., Chicago Heights, Chicago, Ill.
"American Machinist," March 24, 1921



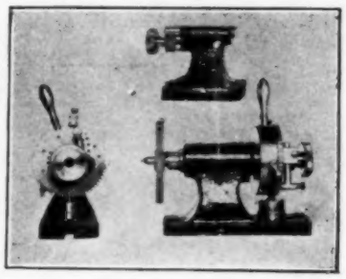
This burning-in and running-in machine is intended for use on automotive engine bearings. It is stated that the machine can be used for any type of motor. The table is raised and lowered by means of a single control. It is grooved and allows the motor clamps to be adjusted to the size of the motor. The center of the table serves as a sump or crankcase for the motor. The clutch is of a heavy toggle type, driving through a silent chain. It is said that the operation is so noiseless that the operator can test the timing of the motor or detect noises after the bearings have been run in. Twenty horsepower is sufficient to run the machine to its capacity under the most severe conditions and with the largest of motors.

Shaper, 9-in.
Carl Pletz & Sons, 3116 Spring Grove Ave., Cincinnati, Ohio
"American Machinist," March 24, 1921



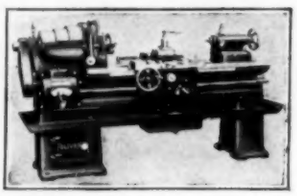
The machine can take cuts up to 9 in. in length, and is intended to handle small shaper work in the toolroom, die shop and experimental shop. It is particularly adapted to small keyseating work. The swivel table is of box section and secured to the saddle with four bolts. It can be swiveled on a horizontal axis to any angle, and a dowel pin locates it at zero. The vise is provided with hardened steel jaws, and it can be swiveled to any angle, the base being graduated. The drive is by a three-step cone pulley, which runs on a sleeve, thus taking the pull of the belt off the pinion shaft. The main bearing is bronze-bushed and provided with an oil reservoir. The shaper can be furnished either without the pedestal for bench use, or mounted on it, as shown.

Indexing Head, Rapid, "Lightning"
Geiras Manufacturing Co., Inc., 417 East 156th St., New York, N. Y.
"American Machinist," March 24, 1921



It is stated that the head can be easily operated by one movement, in a fractional part of a second, from practically any position at the front or end of the milling machine. With nine index plates any division from 2 to 100 with the exception of prime numbers above 40 can be cut. There is no complete circle of holes, but only from to 2 to 5 holes in any one row. An adjustable arm on the plate end of the head is the key for the index plate and spindle, and it has a spring plunger at the end to set in the proper row of holes. A plunger on the base engages the notches on the edge of the plate. The standard device consists of an indexing head, the tailstock, driving plate, draw tube for collets and nine index plate. The swing is 12 inches.

Lathe, "Rapid Production," 16-in.
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," March 24, 1921

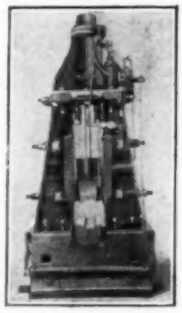


The machine has been simplified over past models, so that it does not contain features not necessary for production work. It is very heavily constructed throughout, with the working parts well guarded. The headstock is driven by a wide belt on a three-step cone pulley. Each step of the cone is large in diameter, so that a powerful drive can be obtained. The large lever shown in front of the headstock operates the clutch for starting and stopping. The headstock can be furnished without back gears, with single back gears, or with double back gears. Four feeds are provided for the carriage through the quick-change gear box. The toolpost is mounted directly on the cross-slide, no swiveling slide being used.

Ladle, Crane, Teapot-Spout
Whiting Corporation, Harvey, Ill.
"American Machinist," March 24, 1921

The spout is formed by the lining, being reinforced by two channels. It is stated that, because of the good balance obtained, the trunnions can be placed nearer the center line of the bowl, thus insuring easier handling while pouring; and that the bowl of the ladle, being of one-piece riveted construction, has little tendency to warp out of shape from usage. The ladle is self-skimming. It may be used with either brick or ganister lining, the latter being somewhat easier to form. It is manufactured in twelve standard sizes, having capacities from 700 to 10,500 lb. of steel.

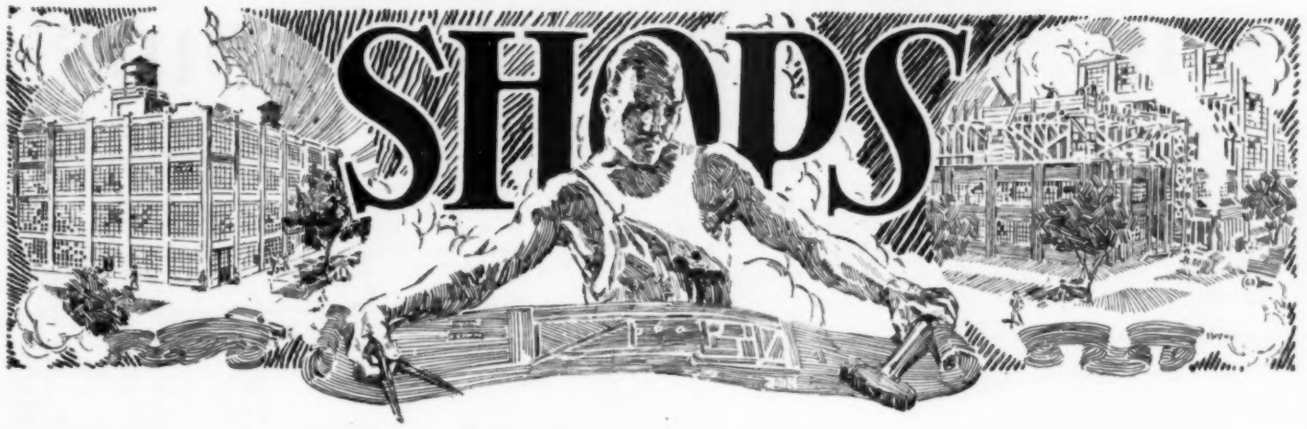
Drop Hammer, Steam, Quick-Acting
Massillon Foundry and Machine Co., Massillon, Ohio
"American Machinist," March 24, 1921



The hammer is built in sizes of 400, 600 and 800 lb. capacity, but other sizes can be built to meet special requirements. It can be operated by compressed air in place of steam, if so desired. The housings and base are steel castings and the cylinder is a semi-steel casting. The construction permits of the ready removal of damaged push-bolts. The guide-adjusting screws are threaded through nuts set in open pockets in the side housings.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., New Bedford—G. G. Sylvia, 543 Union St.—repair equipment for garage.

Mass., East Boston—(Boston P. O.)—A. Limole, 32 Shelby St.—small repair equipment for garage.

R. I., Providence—H. Gladstein, 5 Ambrose St. repair equipment for garage.

R. I., Providence — A. J. Martin, 259 Plain St.—repair equipment for garage.

N. Y., Buffalo—The Houde Eng. Corp., 1392 West Ave., manufacture of automobile shock absorbers, A. B. Shultz, pres.—machinery for proposed factory, including lathes, etc.

N. Y., Buffalo—F. Wittmeyer, 2611 Seneca St. F Wittmeyer, Purch. Agt.—small sash and door sticker.

N. Y., New York—Kleinert & Son, 920 Brook Ave.—two small punch presses, 1 small shaper, 1 small screw machine 1 in. bore, 1 milling machine dividing head.

N. Y., Coney Island — M. C. Illions & Sons, Carousell Wks.—18 in x 16 ft. engine lathe.

N. Y., New York—R. Gair, 350 Madison Ave., manufacturer of paper boxes, etc.—1 sensitive drill press

N. J., West New York—The Omar Co., 220 17th St.—Wells cutter grinder No. 160 and No. 162.

Va., Petersburg—L. J. Moore Hardware Co.—one bench lathe.

La., New Orleans—The Lemmon Bros., 1501 Esplanade Ave.—8 in. or 12 in. screw cuttipg bench lathe for a garage and a ½ stock electric drill, (used).

Pa., Frankford (Philadelphia P. O.)—The Pruyn Ball Bearing Wks., 4408 Paul St.—Four Baird-Warner silent, oblique, cast, octagonal tumbling barrels.

Wis., Milwaukee—Zwebell Bros., 482 Milwaukee St., A. R. Zwebell, Purch. Agt.—machine shop equipment including lathe.

Ill., Pesotum—The Bd. Educ., c/o C. W. Meneley, Clk.—manual training equipment for high school.

La., New Orleans—H. Messner, 824 Girod St.—electric drill, wrenches and woodworking tools for automobile repair shop, (new and used).

Mich., Menominee—The Lloyd Mfg. Co.—one automatic surface grinder and one automatic knife grinder.

Wis., Milwaukee — J. Broenen Co., 410 Madison St. — manufacturer of carriages, lathe and drill press.

Wis., Milwaukee—Amer. Metal Products Co., 671 Kinnickinnic Ave.—G. Staal, Purch. Agt.—lathes and drill presses

Wis., Milwaukee — Auto Mutual Service Co., 208 Palace Theatre Bldg.—A De Pierre, Purch. Agt.—lathe, drill press and grinders for garage and service station.

Wis., Milwaukee — The Nordstrom Vulcanizer Co., 2706 St. Paul Ave., C. Nordstrom, Purch Agt.—small lathe, 3 grinders and blacksmith shop equipment.

Ia., Davenport—G. A. Koester, 721 Perry St.—lathe, drill press and emery wheel.

S. D., Aberdeen—The Bd. Educ., c/o F. Swanson, Clk.—manual training equipment for high school.

S. D., Watertown—The Bd. Educ., c/o J. W. Dougherty, Pres.—machine shop and manual training equipment.

Que., Montreal — The Governors of the Catholic High School, 26 St. Catherine St. —$6,000 worth of equipment for manual training dept., etc.

Machinery Wanted

N. Y., New York—The Banner Silk Knitting Mills, Ralph St. and Grandview Ave., Brooklyn—One No. 306 B. Oster motor driven pipe machine.

La., New Orleans—H. Messner, 824 Girod St. woodworking machinery for automobile repair shop, (new and used).

La., New Orleans—S. J. Pitrie, 629 Baronne St.—equipment for vulcanizing automobile tires.

La., New Orleans — The Van Cleave Garage, 2547 Ursulines St., E. L. Van Cleave, Proprietor—One 3 wheel jack.

O., Cincinnati—The Globe Chemical Co., 727 Ridgeway Ave., F. C. Grote, Purch. Agt. —crusher and grinder to crush soda ash, capacity 500 lb. per hour and a pulverizing mill for Flour-spar to have 1,000 lb. per hour.

Wis., Eau Claire — E. Miller, 312 Eau Claire St.—excelsior making machinery.

Wis., Milwaukee—E. & W. Mfg. Co., 325 Oregon St. manufacturer of trailers and trucks—annealing ovens.

Wis., Milwaukee—Zwebell Bros., 482 Milwaukee St., A. R. Zwebell, Purch. Agt.—additional machinery for machine shop.

Que., Longueuil—E. Charron—complete equipment for sash and door factory.

Que., Quebec—The J. Tanquay Shoe Co., King St.—complete machinery for shoe manufacturing plant.

Metal Working

NEW ENGLAND STATES

Conn., Fairfield — The Porcupine Co., Wordin Ave., Bridgeport, will soon award the contract for the construction of a 1 story, 130 x 320 ft. plant for the manufacture of boilers, etc., on the Post Rd., here. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Consult. Engrs.

Conn., Hartford—Cohn & Feinsilber, 585 Prospect St., are having plans prepared for the construction of a 1 story, 50 x 90 ft. addition to garage. Estimated cost, $20,000. B. A. Sellew, 721 Main St., Archt.

Conn., Hartford—J. Tamburro, 6 Alden St., will build a 1 story garage on Weathersfield Ave. Estimated cost, $25,000.

Mass., Boston — Funk & Wilcox Co., Archts., 294 Washington St., will soon award the contract for the construction of a 6 story addition to garage for the Y.D. Service Garage, Inc., 341 Newbury St. Estimated cost, $600,000. Noted June 2.

Mass., Cambridge—The McKinley Motor Co., 215 River St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on River St. Estimated cost, $20,000.

Mass., East Boston—(Boston P. O.)—A. Limole, 32 Shelby St., will soon award the contract for the construction of a 1 story, 50 x 100 ft. garage on Princeton and Shelby Sts. Estimated cost, $15,000. S. S. Eisenberg, 46 Cornhill St., Boston, Archt.

Mass., New Bedford—G. G. Sylvia, 543 Union St., is having plans prepared for the construction of a 1 story, 80 x 100 ft. garage on James St. Estimated cost, $15,000. Private plans.

Mass., New Bedford — J. Telciano, 267 Allen St., is having plans prepared for the construction of a 1 story, 50 x 75 ft. garage. Estimated cost, $10,000. A. Lawrence, 1328 Rockdale Ave., Archt.

N. H., Berlin—The city has awarded the contract for the construction of a 1 story, 20 x 60 ft. garage and 1 story, 30 x 30 ft. blacksmith shop. Estimated cost, $15,000. Noted Feb. 3.

N. H., Berlin—M. J. Sutton has awarded the contract for altering a 2 story garage. Estimated cost, $20,000.

N. H., Charlestown—The Bowen Motor Power Co. is having new plans prepared for the construction of a 2 story, 57 x 165 ft. garage on Main St. Estimated cost, $80,000. G. W. Griffin, 72 North Main St., Concord, Archt. Noted April 15.

N. H., Nashua—F. H. Putman, Amherst and Broad Sts., has awarded the contract for the construction of a 1 story, 60 x 115 ft. garage and repair station on Amherst St. Estimated cost, $15,000.

THE WEEKLY PRICE GUIDE

This Week's Market

No change in copper. Tin has fluctuated greatly in the last week, going as low as 28¾c. per lb., in 25-ton lots. Zinc unchanged, but lead is off ¼c.

The market for shop supplies is very weak, and prices are useful only as a guide.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.50
Northern Basic	25.32
Southern Ohio No. 2	27.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	34.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75	26.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	*25.00
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.46
Basic	23.96
Bessemer	25.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$3.23	$3.33	$3.09	$3.23
Soft steel bars	3.13	3.23	2.99	3.13
Soft steel bar shapes	3.13	3.23	3.48	3.13
Soft steel bands	4.18	4.28	6.25	
Tank plates	3.23	3.33	3.78	3.23

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2.20
Warehouse, New York, delivered	3.13
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	4.25	4.00	4.13
No. 12	3.15	4.30	4.05	4.18
No. 14	3.20	4.35	4.10	4.23
No. 16	3.30	4.45	4.20	4.33
Black				
Nos. 17 and 21	3.75	4.80	4.80	5.20
Nos. 22 and 24	3.85	4.85	4.85	5.25
No. 25 and 26	3.90	4.90	4.90	5.30
No. 28	4.00	5.00	5.00	5.40
Galvanized				
No. 10 and 11	4.00	4.75	5.00	5.70
No. 12 to 14	4.10	4.85	5.10	5.80
Nos. 17 and 21	4.40	5.15	5.40	6.10
Nos. 22 and 24	4.55	5.30	5.55	6.25
No. 26	4.70	5.45	5.70	6.30
No. 28	5.00	5.75	6.00	6.40

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.73	$4.63	$4.25
Flats, squares and hexagons, per 100 lb	5.23	4.63	4.75

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	5.50	8.00	8.25
Spring steel (light)	8.00	7.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.64	3.69	3.83
Cold rolled strip steel	6.00	8.25	7.90
Floor plates	5.30	3.09@3.40	5.78

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of April 13, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	62½	50	⅜	33½	18½
			1 to 1¼	35½	20½

LAP WELD

2	54½	41	2	30½	16½
2½ to 6	58½	45	2½ to 4	34½	22½
7 to 12	54½	44	4½ to 6	33½	21½
13 and 14	45	37	7 to 8	24½	12½
15	42½	32	9 to 12	19½	7½

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60½	49	1 to 1¼	35½	21½
2 to 3	61½	50			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	52½	41	2	31½	18½
2½ to 4	56½	45	2½ to 4	34½	22½
4½ to 6	55½	44	4½ to 6	33½	21½
7 to 8	50½	37	7 to 8	24½	12½
9 to 12	45½	32	9 to 12	19½	7½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20-5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	14.25
Tin in 5-ton lots	30.25
Lead	5.25
Zinc	5.75
ST. LOUIS	
Lead	4.85
Zinc	5.35

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	21.75	22.50	23.50
Copper wire (carload lots)	15.75	17.50	20.00
Brass sheets	17.00	21.00	20.75
Brass pipe	20.75	24.00	24.50
Solder (half and half) (case lots)	24.00	23.50	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15.00
Cleveland	18.00
Chicago	18.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	41
Electrolytic	43

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.00
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	$10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	8.00	8.00
Lead, heavy	3.25	4.00	3.75
Lead, tea	2.00	3.00	2.75
Brass, heavy	6.00	6.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.00	5.00
Zinc	3.00	3.00	3.50

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.4	25.50@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.75
Chicago	20.50
Cleveland	22.50

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	43.50	35.00
Commercial	30.00	15.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufaoturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$2.00	1.60
Hot pressed hexagon	List	2.00	1.60
Cold punches hexagon	List	2.00	1.60
Cold punched square	List	2.00	1.60

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	50%
Cleveland	75–10%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50–10%	60–10%	50%
1½ and 1¾ in. by 3 in. up to 12 in.	50%	50–5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $4.00 Chicago..... $4.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50–10%	40%
Larger and longer up to 1 in. by 30 in.	40%	50%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ½ and smaller	50%	60%	45%
Tinned	45%	60%	30%

Structural, ½, ¾, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.65 Cleveland...$4.60 Chicago....$4.88 Pittsburgh..$3.70
Boiler, same sizes:
New York...$4.75 Cleveland...$4.70 Chicago....$4.98 Pittsburgh..$3.80

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	20.00	23.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$7.00 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	9.00@12.00	12.50	14.25
Colored mixed	6.50@ 9.50	9.50	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$3.25@$3.75
Prompt foundry	4.50@ 5.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.88	$0.87
5-gal. cans	.83*	1.03	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

R. I., Providence—A. J. Finan, 83 Standiford St., plans to build a 1 story garage and service station on Plain St. Estimated cost, $30,000. Private plans.

R. I., Providence — H. Gladstein, 5 Ambrose St., will soon award the contract for the construction of a garage and service station on Shawmut and Kane Sts. Estimated cost, $20,000. Private plans.

R. I., Providence — B. Kauffman, 109 Bway., plans to build a 1 story garage and service station on Federal St. Estimated cost, $6,500.

R. I., Providence—R. E. Arter, 276 West Exchange St., will soon award the contract for the construction of a 1 story garage and service station to cover 18,000 sq.ft. of floor space on North Main and Frost Sts. Estimated cost, $75,000. C. H. Lockwood, 171 Westminister St., Archt. Noted June 9.

R. I., Providence—S. Bomes, 71 Farragut Ave., will build a 1 story garage and service station on Warrington St. Estimated cost, $30,000. Noted March 10.

R. I., Providence — A. J. Martin, 259 Plain St., plans to build a 1 story, 60 x 110 ft. garage and service station on Plain St. Estimated cost, $30,000. Private plans.

R. I., Providence—W. A. Mulry Co., 97 Empire St., has awarded the contract for the construction of a 1 story, 120 x 135 ft. garage and service station on Elmwood Ave. and Russell St. Estimated cost, $75,000. Noted April 21.

R. I., Providence—J. H. McElroy, 37 Tyndall Ave., plans to build a 1 story garage and service station on Broad and Corinth Sts. Estimated cost, $35,000. Private plans.

MIDDLE ATLANTIC STATES

N. Y., Brooklyn—Walzer Bros., 44 Court St., will build a 1 story, 100 x 175 ft. garage on North 8th St. Estimated cost, $50,000.

N. Y., Buffalo—The Houde Eng. Corp., 1392 West Ave., is having plans prepared for the construction of a 2 story, 37 x 100 ft. factory for the manufacture of auto shock absorbers on West Ave. Estimated cost, $18,000. G. W. Wolf, 1377 Main St., Buffalo, Archt.

N. Y., Long Island City—The Interstate Land Holding Co., c/o F. S. Parker, Archt. and Engr., 44 Court St., Brooklyn, has had plans prepared for the construction of a 2 story, 100 x 215 ft. service station on William and 13th Sts. Estimated cost, $100,000.

N. Y., New York—C. H. Burdett, c/o C. B. Meyers, Archt. and Engr., 1 Union Sq., is having plans prepared for the construction of a 2 story, 85 x 100 ft. garage, at 553 West 133d St. Estimated cost, $90,000.

N. Y., New York—I. Langer, 700 Trinity Ave., is having plans prepared for the construction of a 1 story, 100 x 160 ft. garage on Jumel Pl. near 167th St. Estimated cost, $50,000. Dunnigan & Crumley, 394 East 150th St., Archts. and Engrs.

N. Y., New York—S. Marer, c/o Dunnigan & Crumley, Archts. and Engrs., 294 East 150th St., is having plans prepared for the construction of a 2 story garage on University Ave. near 195th St. Estimated cost, $60,000.

N. Y., New York—L. H. Redner, 200 West 71st St., is having plans prepared for the construction of a 2 story garage at 327 West 69th St. Estimated cost, $100,000. C. B. Meyers, 31 Union Sq., Archt. and Engr.

Pa., Philadelphia — H. Shaprio, 2d and Oakland Aves., is having plans prepared for the construction of a coal trestle, office and garage. Estimated cost, $150,000. Clark & Dudnick, Drexel Bldg., Archts. and Engrs.

Pa., Pittsburgh—The Oliver Iron & Steel Wks., 10th and Muriel Sts., has awarded the contract for the construction of a 4 story, 60 x 120 ft. addition to its factory on 12th and Muriel Sts. Estimated cost, $125,000.

MIDDLE WEST STATES

Ind., Elkhart — The Haynes Realty Co. plans to build a 5 story, 80 x 110 ft. office and garage building. Estimated cost, $100,000. A. H. Elkhart & Son, Haynes Bldg., Archts.

Ind., Evansville — The Tri-State Motor Corp. plans to build a 3 story, 67 x 130 ft. garage and salesroom on 1st and Locust Sts. Estimated cost, $75,000. Shopbell & Co., Furniture Bldg., Archt.

Ind., Ft. Wayne—The Visible Pump Mfg. Co. has awarded the contract for the construction of a 2 story, 80 x 80 ft. factory and office building. Estimated cost, $75,000.

Ind., Indianapolis—The Amer. Valve & Tank Co. plans to build a 1 story, 50 x 150 ft. factory for the manufacture of valve and steel products on Mars Hill. Estimated cost, $30,000. Private plans.

Mich., Detroit — A. E. Harley, Archt., 2631 Woodward Ave., will soon award the contract for the construction of a 2 story, 110 x 125 ft. garage and service station on Grand River and Arcadia Aves., for Cross & Moore. Estimated cost, $125,000.

O., Dayton—The Platt Iron Wks. Co., Valley St., plans to build a 2 story factory for the manufacture of pumping equipment on Keowee and Valley Sts. Estimated cost, $60,000. Private plans.

O., Dayton—C. Sheffer Co., South Main St., has awarded the contract for the construction of a 1 and 2 story, 50 x 80 ft. dry cleaning plant including office building and garage on Main and Apple Sts. Estimated cost, $60,000.

STATES WEST OF THE MISSISSIPPI

Ia., Davenport—G. A. Koester, 741 Perry St., has awarded the contract for the construction of a 3 story, 64 x 150 ft. salesroom and garage on Grady St. between Front and 2d Sts. Estimated cost, $150,000.

Mo., St. Louis—O. J. Popp, Archt., Odd Fellows Bldg., will receive bids until June 23 for the construction of a 1 and 2 story, 100 x 150 ft. factory for the manufacture of wire on Chouteau and Spring Sts., for the Usona Mfg. Co., c/o F. C. Long, Pres., 826 South 18th St. Estimated cost, $75,000.

Mo., Trenton—The Chicago Rock Island & Pacific Ry. Co., La Salle St. Terminal, Chicago, Ill., has had preliminary plans prepared for the construction of a 1 story, 85 x 400 ft. car repair shop here. Estimated cost, $75,000. A. T. Hawk, Archt. Noted June 2.

General Manufacturing

NEW ENGLAND STATES

Conn., Bridgeport — The Nichols Underwear Corp., 23 Benham Ave., is having preliminary plans prepared for the construction of a 2 story, 50 x 100 ft. addition to its factory. Estimated cost, $50,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Archts. and Engrs.

Conn., East Windsor—(Warehouse Point P. O.)—The Apothecaries Hall Co., Wholesale Druggists, 63 Bank St., Waterbury, has awarded the contract for the construction of a 1 story, 65 x 140 ft. fertilizer plant. Estimated cost, $30,000. Noted June 9.

Conn., Norwalk—C. H. Harris, Inc., 136 West 24th St., New York City, has awarded the contract for the construction of a 1 story, 100 x 200 ft. factory for the manufacture of windshields and other glass products on Main St. Estimated cost, $75,000. Noted May 26.

Conn., Stafford Springs — The Warren Woolen Co. has awarded the contract for the construction of a 3 story, 48 x 59 ft. factory for the manufacture of woolen goods on Furnace Ave. Estimated cost, $26,000.

Mass., Northampton — The Northampton Hosiery Co., c/o W. C. Van Brunt, Treas., c/o New England Tire & Rubber Co., Holyoke, plans to remodel hosiery mill on Clark Ave. Estimated cost, $25,000. Private plans.

Mass., Somerville—(Boston P. O.)—The Winchester Mfg. Co., 12 Beacon St., has awarded the contract for the construction of a 2 story, 55 x 125 ft. factory for the manufacture of novelties on Beacon St. Estimated cost, $50,000. Noted June 2.

Mass., Springfield—The C. P. Chase Co., 68 Birnie Ave., will soon award the contract for the construction of a 1 story, 40 x 120 ft. lumber mill, etc. H. L. Sprague, 310 Main St., Archt.

Mass., Springfield—The C. P. Chase Co., 68 Birnie Ave., has awarded the contract for rebuilding a 1 story, 50 x 150 ft. lumber mill plant which was recently destroyed by fire. Estimated cost, $25,000.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—The Hall Baking Co., 2381 Fillmore Ave., has awarded the contract for the construction of a 2 story, 50 x 102 ft. factory. Estimated cost, $60,000. Noted Feb. 17.

N. J., East Orange — C. B. Comstock, Engr., 110 West 40th St., New York City, will soon award the contract for the construction of a 3 story top and 5 story side addition to bakery here, for the Ward Baking Co., Southern Blvd., New York City.

SOUTHERN STATES

Fla., New Smyrna — J. N. McGaughey plans to build a 10 ton ice plant. Estimated cost, $25,000.

Fla., Wauchula—J. G. Fancy and Associates, Ft. Meade, plans to build an electric ice and cold storage plant, here. Estimated cost, $50,000.

MIDDLE WEST STATES

Ind., Indianapolis—The Bookwalter-Ball Co., Century Bldg., has awarded the contract for the construction of a 1 story, 60 x 208 ft. printing plant at 429 North Capitol Ave. Estimated cost, $30,000.

Ind., Princeton—The Hudson Baking Co. plans to build a 2 story, 60 x 130 ft. bakery, here. Estimated cost, $40,000. Fowler, Choppel & Troutman, Evansville, Archts.

Mich., Bay City—The Wildman Rubber Co., c/o J. C. McCabe, Secy., 316 Phoenix Bldg., has awarded the contract for the construction of a 3 story, 60 x 260 ft. tire factory. Estimated cost, $300,000.

Mich., Saginaw—The Booth & Boyd Lumbe Co., Baum and Holden Sts., is having plans prepared for the construction of a 1 story, 72 x 400 ft. woodworking factory. Estimated cost, $40,000. Cowles & Mutscheller, Chase Blk., Archts.

Wis., Haugen—The Haugen Box & Crating Co., c/o E. Brunett, plans to build a 3 story, 60 x 95 ft. box factory on Main St. Estimated cost, $40,000 Architect not selected.

Wis., Neenah—The Valley Paper Co., c/o W. F. Wolf, Pres., Appleton, plans to build a 60 x 120 ft. paper mill on Main St., here. Estimated cost, $100,000. Architect not selected.

STATES WEST OF THE MISSISSIPPI

Mo., Joplin—The Duplex Tire & Rubber Co., New Yates Hotel is having plans prepared for the construction of a 3 story, 100 x 300 ft. factory. Estimated cost, $150,000. R. W. Crissey, Pres. Osborn Eng. Co., 2848 Prospect Ave., Cleveland, O., Archt. and Engr. Noted June 2.

CANADA

Que., Quebec—The Canada Candy Mfg. Co., St. Dominique St., will receive bids until June 30 for the construction of a 3 story, 50 x 82 ft. factory. Estimated cost, $100,000. J. A. Caron, c/o Owner, Archt.